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The Palms of British East India. *By* W. GRIFFITH, *Esq. F. L. S. Memb. Imp. Acad. Natur. Curios., Royal Ratisb. Botan. Soc., Corr. Memb. Hortic. Socy. of London, Asst. Surgeon, Madras Establishment.*

[Continued from page 103.]

SUB-FAMILIA.—CORYPHINÆ. *Mart. Palm. p.* 231.

Flores hermaphroditi, rarius polygami, rarius dioici. *Ovaria* 3, discreta aut partim cohærentia. *Fructus* drupaceus vel baccatus, monospermus, ovario unico plerumque tantum maturato. *Albumen* corneum, æquabile vel centro-cavum, vel processu tegumentorum intrante excavatum vel exaratum. *Embryo* sæpius dorsalis, rarissime subbasilaris.

Palmæ *perennantes vel monocarpicæ, frutescentes vel arboreæ.* Folia *sæpissime flabelliformia, raro pinnata.* Inflorescentia *axillaris, raro terminalis.* Spathæ *plures incompletæ, vaginantes, rarius una completa; secondariæ plerumque deficientes.*

SECT. I.—FOLIA FLABELLIFORMIA.

CORYPHA.—*Monocarpicæ,* arboreæ, terminifloræ. Folia palmatim partita, flabelliformia. *Spathæ secondariæ et tertiariae tot quot rami spadicis.* Flores

hermaphroditi, glomerulati. Corolla tripetala. Bacca sub-exsucca. *Albumen centro-cavum vel solidum. Embryo verticalis.*

LIVISTONA.—Perennes, arboreæ, axillifloræ. Folia palmatim partita, flabelliformia. Flores hermaphroditi, glomerulati. Corolla tripartita. Drupa. *Albumen processu intrante excavatum.* Embryo dorsalis.

LICUALA.—Perennes, frutescentes, axilliflorae. *Folia pinnatim flabelliformia.* Flores hermaphroditi, solitarii, binati vel ternati? tribracteati. Corolla tripartita. *Filamenta in annulum faucinum sæpissime coalita.* Drupa, etc. præcedentis.

CHAMÆROPS.—Perennes, frutescentes vel arboreæ, axilliflorae. Folia palmatim-partita, flabelliformia. *Flores polygami.* Corolla tripetala. Bacca. *Semen longitudinaliter sulcatum.* Embryo dorsalis.

SECT. II.—FOLIA PINNATA.

PHŒNIX.

SUB-FAMILY.—CORYPHINÆ.

Flowers hermaphrodite, seldom polygamous, rarely diœcious. Ovaria three, distinct or partly cohering. Fruit a berry or a drupe, generally solitary, one ovarium only being matured, 1 seeded. Albumen horny, equal, solid or hollow in the centre, or excavated on the surface, or subruminate. Embryo dorsal

LEAVES FAN-SHAPED.

Palmately divided.	Large trees flowering only once. Inflorescence terminal; secondary and tertiary spathes many. Flowers hermaphrodite, several together. Corolla three petalled. Stamens hypogynous. Berry almost juiceless. Albumen hollow in the middle or solid. Embryo near the apex.	CORYPHA.
	Perennial trees. Inflorescence axillary. Flowers hermaphrodite, several together. Corolla tripartite. Stamens perigynous. Fruit a drupe. Albumen with a cavity communicating exteriorly and filled with the integuments. Embryo about the middle of the dorsal face. ..	LIVISTONA.
	Perennial. Inflorescence axillary. Flowers polygamous, several together. Corolla tripartite. Stamens hypogynous. Fruit a berry. Seed with a longitudinal furrow.	CHAMÆROPS.

Pinnately divided. ..	Perennial. Inflorescence axillary. Flowers hermaphrodite, solitary, or two or three together. Corolla tripartite. Stamens perigynous: filaments at the faux combined into an annulus. Fruit as in Livistona.	LICUALA.
LEAVES PINNATE.	...	PHŒNIX.

SECT. I.

Folia flabelliformia. *Flores* hermaphroditi, rarius polygami. *Spathæ* plures incompletæ. *Corolla* valvata. *Stamina* 6, sæpius perigyna. *Styli* connati. *Drupa* rarius *bacca*. *Semen* superficie læviusculum, vel (in Clamæropide) verticaliter sulcatum. *Albumen* centro-cavum, vel processu intrante excavatum, vel (in Chamæropide) exaratum, interdum sub-ruminatum.

Palmæ *frutescentes vel arboreæ, perennantes vel monocarpicæ, in umbrosis humidisque vigentes.* Folia *palmatim vel* (in Licuala) *pinnatim flabelliformia, interdum maxima, plicata, laciniis ut plurimum bifidis :* petioli *inermes vel sæpius secus margines aculeati.* Spadices *perennantium axillares, monocarpicarum terminales, maximae.* Spathæ *plures, incompletae, vaginantes.* Flores *sessiles, solitarii vel sæpe glomerulati, sæpe obscure 1-bracteati.* Stamina *in tripetalis libera, hypogyna, in reliquis perigyna, filamentis sæpe in annulum faucinum coalitis.* Antheræ *versatiles.* Ovarium *sæpius vertice exsculptum.* Baccæ drupæve *olivaceæ, rubræ vel cyaneæ.*

Incolæ Americæ tropicæ, Australiæ, et Asiæ præsertim ultragangeticæ et archipelagicæ. Species una Mediterranea, altera Affghanensis. Limes borealis specierum indicarum 30-31 grad. alt. supra mare 1,000—1,500 pedum.

Usus.—Foliorum pinnis exsiccatis inscribere solent indigenæ.

CORYPHA.

Linn. (*Mus. Cliff.* 11.) *Gen. Pl. ed.* 6*ta. p.* 572. *No.* 1221. *ed. Schreber. p.* 774. *No.* 1690. *Syst. Pl. ed. Schult.* 7. *p.* lxxviii. *No.* 1493. *Juss. Gen. p.* 39. (partim.) *Gærtn.*

Fruct. et. Sem. 1. *p.* 18. *t.* 7. (semine inverso.) *Lam. Enc. Meth. t.* 899. (e Rheede et Gærtner.) *R. Br. Pr. Fl. Nov. Holl. ed.* 2*da. p.* 123. *Roxb. Fl. Ind.* 2. *p.* 174. *Icones.* 7. *t.* 37. *Suppt.* 3. *t.* 80. *Mart. Progr. p.* 10. (partim.) *Palmæ.* 231. *Endl. Gen. p.* 252. *No.* 1753.

Codda-Pana. *Rheed. Hort. Mal.* 3. *p.* 1. *t.* 1-12.

Taliera. *Mart. Progr. p.* 10. *Syst. Pl. ed. Schult.* 7. *p.* lxxviii. *No.* 1492.

Gembanga. *Blume. in Bot. Zeit.* (1825.) 2. *p.* 580. *et* 678. (e Martio.)

CHAR. GEN.—*Flores* hermaphroditi. *Calyx* tridentatus. *Corolla* tripetala. *Stamina* 6, hypogyna, filamentis basi distinctis. *Ovaria* 3, cohærentia. *Styli* connati. *Fructus* (unicus sæpius maturescens) baccatus, monospermus. *Albumen* corneum, centro-cavum (unius solidum.) *Embryo* versus apicem albuminis.

HABITUS.—Palmæ *asiaticæ arboreæ, proceræ, monocarpicæ.* Truncus *annulatus vel spiraliter sulcatus.* Corona *maxima, ampla.* Petiolorum *margines aculeati.* Rete O. Lamina *palmatim multipartita, laciniis apice bilobis.* Inflorescentia *terminalis, amplissima.* Spathæ *primariæ et secondariæ plurimæ.* Flores *glomerulati breve pedicellati, flavescentes.* Fructus *olivacei seu flavescentes.*

Affinitas proxima cum Livistona (confer R. Br. Prod. p. 123, adnot.) Discrimina majora constant in vita monocarpica, inflorescentia terminali et spathis secondariis.

50. (1) C. *elata,* trunco spiraliter sulcato, petiolis spiraliter dispositis exauriculatis, lamina (petiolo breviore) plana, laciniis 85-90 profundis lineari-ensiformibus obtuse bilobis posticis cum petiolo angulum acutum efformantibus, glomerulis florum distantibus, petalis lanceolatis, fructibus sclopeti globuli magnitudine, embryone versus apicem albuminis solidi.

C. elata, *Roxb. Fl. Ind.* 2, *p.* 176. *Icones Suppt* 3. *t.* 80. *Mart. Palm. p.* 233.

HAB.—Bengal, flowering in March and April: the seeds require about 12 months to ripen. *Bujoor* or *Bujur-batool*, Beng. (*Roxb.*) Cultivated in the Botanic and some other Gardens about Calcutta. I have not seen it in flower or fruit.

DESCR.—" *Trunk* straight, but often varying in thickness. I have two trees, which were pretty well ascertained to be about thirty years old when in flower; one was seventy feet to the base of the inflorescence, the other about sixty; circumference near the root eight feet, and about the middle of the trees five and a half or six: their whole length strongly marked with rough, dark coloured, spiral ridges, and furrows, which plainly point out the spiral arrangement of the leaves. The ligneous fibres, as in the order, are on the outside, forming a tube for the soft spongy substance within, of dark chocolate colour, tough and hard, but by no means equal, in either quantity or quality, to the very serviceable wood of *Borassus flabelliformis*.

Leaves round the top of the trunk, immediately under the base of the inflorescence, numerous, palmate, pinnatifid, plaited, from eight to ten feet each way; *segments* generally from forty to fifty pair, united about half their length, ensiform, apices rather obtuse and bifid, texture hard, smooth on both sides. When the tree begins to blossom, the leaves wither and soon fall off, leaving the fructiferous part naked. *Petioles (stipes)* from six to twelve feet long, concave above, with the thin, hard, black margins thereof cut into numerous, very short, curved spines. *Spathes* numerous, there being one at each joint of the various ramifications of the spadix, all smooth and when recent, of a pale yellowish green. *Inflorescence*, (spadix) terminal; it may be called an immense, more than supra-decompound, round panicle; in this species it is of a much smaller span than the leaves, and only about one-fourth or one-fifth part of the whole height of the tree; the various and innumerable ramifications are always alternate, smooth and of a pale yellow colour.

Flowers small, sessile, collected in little bundles over the ultimate divisions of the panicle, pale yellow, small, rather offensive. *Calyx* small, 3-toothed. *Petals* three, oblong, reflexed, shorter than the stamina. *Filaments* six, broad at the base, and there united, toward the apex slender and incurved. *Anthers* ovate. *Germ* superior. round-ovate, 3-lobed, 3-celled, with one *ovulum* in each, attached to the bottom of its cell. *Style* short, 3-grooved. *Stigma* 3-lobed. *Berry* globular, the size of a musket ball, olive-coloured, smooth when fresh, but it soon becomes dry and wrinkled, 1-celled; the two abortive lobes of the germ are always to be found at the base. *Seed* solitary, subglobular. *Integuments* apparently two, but they are firmly united, and of a friable texture; the *exterior* one pale yellowish brown, and veined; the *interior* one brown, and adhering firmly to the perisperm. *Perisperm* conform to the seed, of a hard, horny texture, and a pale gray colour. *Embryo* simple, short, cylindric, lodged near the apex of the perisperm." (*Roxb. o. c. l. c.*)

To this I have to add that the petioles are much more slender than in the other species, their sides marked with oblique furrows, corresponding with the teeth, which are very large. They separate a little above the base: this afterwards becomes longitudinally split, and long afterwards falls off. The lamina describes nearly a complete circle; length 5-6 feet, breadth 15 feet; the posterior pinnæ do not meet, much less overlap. Laciniæ about 85; linear-ensiform, much narrower than in the others: the central are about 3 feet long; the lateral and intermediate about 3½ feet; the posticous ones towards the base present denticulate margins.

This Palm will be at once recognised by its black spirally marked trunk. From the other species of Corypha it is abundantly distinct by its long, obviously spirally placed, exauriculate petioles, and by the smaller, dark green, flat lamina with narrow, linear-ensiform segments. The fruit is also smaller.

According to Roxburgh's drawing, the inflorescence of this is so dense that no part of the spadix or spathes is visible,

and the outline is irregularly pyramidal, some of the branches being much larger than others.

52. (2) C. *Talliera*, trunco obsolete annulato, petiolis bi-auriculatis, lamina (petiolum excedente) glaucescente a medio supra conduplicata, laciniis 80-90 ensiformibus bilobis posticis incumbentibus, glomerulis florum approximatis, petalis oblongis æstivatione imbricatis, fructibus pomi minoris magnitudine rugosis, embryone in apice albuminis centro cavi.

C. Talliera, *Roxb. Cor. Pl.* 3. *p.* 51. *t.* 255-256. (auct. Mart.) *Icones* 7. *t.* 37. *Fl. Ind.* 2. *p.* 174. *Mart. Palmæ. p.* 231. Taliera benghalensis. *Spreng. Syst.* 2. *p.* 18. Taliera Tali. *Mart. Syst. veg. ed. Schult.* 7. *p.* 1306.

Hab.—Bengal, scarce in the vicinity of Calcutta. Flowers at the beginning of the hot season, seeds ripen 9 or 10 months afterwards. *Tara, Tallier, Tareet*, Beng. (Roxb.) Cultivated in the Botanic Gardens. I have not seen the flowers or fruit.

Descr.—" *Trunk* perfectly straight, about thirty feet high, and as near as the eye can judge equally thick throughout, of a dark brown colour, and somewhat rough with the marks left by the impression of the fallen leaves. *Leaves* palmate-pinnatifid, plaited, subrotund. *Leaflets* or divisions of the frond united rather more than half way, numerous, generally about eighty, (or forty pairs,) linear-lanceolate, pointed until broken by the wind, or otherwise, polished on both sides, with a strong somewhat four-sided rib running their whole length ; generally about six feet long, greatest breadth about four inches. The thread which forms part of the *Linnæan specific character* of *Corypha umbraculifera*, is sometimes present, sometimes wanting, at best such perishable marks deserve no notice. *Petioles* from five to ten feet long, remarkably strong, upper side deeply channelled, the sharp margins armed with numerous, short, strong, dark-coloured polished, compressed spines. *Spathes* just as numerous as the primary and secondary ramifications in the spadix, all smooth, and obtuse. *Spadix* supra-decompound, issuing in the

month of February from the apex of the tree, and centre of the leaves, forming an immense, diffuse, ovate panicle, of about twenty or more feet in height, so that the height of the whole tree, from the ground to the top of the spadix is now about fifty feet. Primary branches alternate, round, spreading nearly horizontally with their apices ascending. Secondary ramifications alternate, bifarious, compressed, drooping, recurved, soon dividing into numerous, variously curved, smaller, subcylindric, branchlets covered with innumerable, small white, odorous, subsessile flowers. *Calyx ; perianth* inferior, minute, obscurely 3-toothed. *Petals* three, oblong, concave, fleshy, smooth, expanding, many times larger than the perianth. No nectary. *Filaments* six, nearly of the length of the petals, at the base broad, and in some measure united. *Anthers* ovate. *Germ* 3-lobed, 3-celled with the embryo of a distinct seed in each, attached to the bottom of its cell. *Style* shorter than the stamina. *Stigma* simple. *Berries* from one to three conjoined, though one is the most common, and then the rudiments of the other two are present, they are singly quite round, about the size of a crab-apple, when ripe, wrinkled, and of a dark olive, or greenish yellow colour. The pulp is but in small proportion, and yellow when the fruit is ripe. *Seed* solitary, round, attached to the base of the berry, of a white colour, and horny substance, with a small vacuum in the centre. *Embryo* lodged in the apex, which circumstance alone, is sufficient to distinguish it from *Gærtner's Corypha umbraculifera.*

The leaves of this tree are employed by the natives to write on with their pointed steel bodkins, and also to tie the rafters of their houses, for they are said to be strong and durable. I do not find that the wood is applied to any useful purpose." (*Roxb. o. c. l. c.*)

This species is so closely allied to C. umbraculifera, as to be difficult to distinguish when out of flower. The Garden specimens are distinguishable by the lamina of the leaf of this species being conduplicate from the middle upwards, and by the posticous segments overlapping, so that the whole becomes peltate.

The leaves are very like those of Borassus flabelliformis, but much larger. The petioles are bi-auriculate and with-

out an obvious spiral arrangement, they separate at the top of the dilated part, and subsequently fall off leaving a smooth trunk. The lamina is 5-6 ft. long, 15 ft. broad, glaucescent; the segments 90-95, deeper and broader than in C. umbraculifera, the central being 3-3½ feet long.

Roxburgh's drawing represents the inflorescence as conical pyramidal, longer than the crown of leaves, open so that the spathes and branches are seen distinctly, and these last as regularly diminishing upwards.*

53. (3) C. *umbraculifera*, trunco annulato, petiolis exauriculatis, lamina (petiolum subæquante) a medio supra conduplicata, laciniis 90-100 parum profundis ensiformibus bilobis posticis cum petiolo angulum acutum exhibentibus, glomerulis florum approximatis, fructibus pomi minoris magnitudine et forma, embryone in apice albuminis centro cavi.

C. umbraculifera, *Linn. Spec. Pl. ed. 2da. p.* 1657. *Fl. Zeyl. p.* 187. (excl. syn. Rumphii.) *Gærtn. Fruct. et. Sem.* 1. *p.* 18. *t.* 7. sem. inverso (excl. syn. Rumphii.) *Willd. Sp. Pl.* 2. *p.* 201. *Spreng. Syst. Veg.* 2. *p.* 138. *Lam. Enc. Meth.* 899. (e Rheede et Gærtner.) *Syst. Veg. ed. Schultes.* 7. *p.*

* I subjoin descriptions of flowers and fruit from Garden specimens with the name C. umbraculifera, but which I believe to belong here.

Flower-bearing branches often dichotomous above the mouths of their spathes, about 2 inches long. *Flowers* several together, on short stout subannulate stalks, among the bases of which small scales may be found. *Calyx* short, cup-shaped, with three very rounded teeth. *Corolla* 3-times longer than the calyx, petals oblong, concave, very spreading in bud, imbricate! *Stamina* 6; *filaments* stout subulate, about as long as the petals, those opposite the petals being twice as broad; *anthers* oblong-ovate. *Ovarium* globose turbinate, 3-lobed, each lobe with 3 depressed areolæ on its vertex. *Style* about as long, stout, subulate, 3-furrowed. *Stigma* subsimple. *Ovula* solitary, erect, anatropous.

Fruit globose, substance excepting the cutis rather thick, homogeneous, fleshy, cellular. *Seed* erect, oblong roundish; tegument externally cellular, coriaceous, internally blackish, subosseous, adhering firmly to the very dense, hollow in the centre, horny *albumen*. *Embryo* situated rather obliquely in the apex of the albumen, the cavity containing it communicating with the central cavity of the albumen.

1308. *Roxb. Fl. Ind.* 2. *p.* 177. *Mart. Palm. p.* 232. Codda Pana. *Rheede. Hort. Mal.* 3. *t.* 1-12.

Hab.—Ceylon, Malabar Coast. *Tala* or *Talagas.* Cinghalese. *Condapari.* Tamul. (*Roxb.*) *Codda-Pana.* Malabar. (*Rheede.*) *Tallipot Palm.* I have not seen it in flower or fruit.

Descr.—Habit very much like that of C. Talliera. *Leaves* larger than those of C. Talliera; in native places immense. *Petioles* stout, 7-feet long, channelled, margins with horny, irregular, often paired teeth. *Lamina* describing nearly a complete circle, 6 feet long, 13 feet broad, from the middle upwards conduplicate, but not so much so as in C. Talliera; laciniæ 95-100, ensiform, obtusely bifid, the central ones 1¼ foot long, the intermediate ones 1¾, the posticous not meeting or overlapping, but forming acute angles with the petiole. *Inflorescence* much the same as in C. Talliera.

I have specimens of part of the inflorescence, from trees round some of the pagodas at Mergui, most probably belonging to this species. I subjoin a description.

Descr.—*Flower-bearing branches* 18-20 inches long, lower divisions bi-trichotomous, the rest simple; these are about a foot long, subulate, covered with warty protuberances (the situations of the flowers.)

Flowers several together on short subannular stalks, at the base of which small scales exist. *Calyx* cup-shaped, small, with three very short teeth. *Petals* broader, spreading, 3-4 times longer than the calyx: subvalvate in æstivation, upper edges quite so. *Stamina* 6; *filaments* rather shorter than the petals, about equal, stout, subulate; *anthers* oblong, ovate in bud, much larger than those of C. Talliera. *Ovarium* conical from a round base, three-lobed, attenuated into a stout subulate three-furrowed *style*, which is rather longer than the ovarium. *Stigma* simple. *Ovula* solitary, erect.

I have no means of ascertaining to what species these specimens really belong, not having access to a complete copy of

Martius' Palms, where the necessarily minute examination can only be expected; but probability is in favour of their belonging to C. umbraculifera. If this is the case, the æstivation of the corolla, and shape of the ovarium will assist the specific distinction.

LICUALA.

Rumph. Hb. Amb. 1. *p.* 44. *t.* 9. *Thunb. Nov. gen. p.* 70. *Linn. Gen. Pl. ed. Schreb.* 2. *p.* 774. *ed. Spreng. p.* 149. *No.* 1300. *Jussieu. Gen. Pl. p.* 39. *Gærtner. Sem. et. Fruct.* 2. *p.* 268. *t.* 139. *Syst. Veg. ed. Sch.* 7. *p.* 77. *No.* 1490. *Roxb. Fl. Ind.* 2. *p.* 179. *Icones. Suppt.* 3. *t.* 79. *Mart. Progr. p.* 9. *No.* IV. *Palmæ. p.* 234. *t.* 134, 135, 162. *Endl. Gen. Pl. p.* 252. *No.* 1755.

Char. Gen.—*Flores* hermaphroditi. *Perianthium* utrumque tripartitum. *Stamina* 6, filamentis (a corolla liberifactis) in annumul sæpissime coalitis. *Drupa* (unica maturescens) monosperma. *Albumen* cavitate ventrali. *Embryo* dorsalis.

Habitus.—Palmæ *Asiae orientalis et archipelagicae incolae, frutescentes, interdum subacaules.* Caulis *ut plurimum annulatus, interdum basibus petiolorum persistentibus induratis exasperatus.* Folia *pinnato-flabelliformia*; petioli *sæpissime secus margines aculeis corneis conicis saepius aduncis armati*; pinnæ *cuneiformes, apice plus minus truncatae, lobatae, lobis bifidis.* Spadix (*initio siliquaeformis*) *spicatim vel paniculatim ramosus.* Spathæ *tubulosae, ore obliquo bilobo.* Flores *solitarii, bini vel terni, saepe extus pubescentes.* Ovarium *vertice exsculptum.* Carpidia *apicibus cohaerentia.* Drupæ *miniatae vel rubrae.*

54. (1) L. *spinosa*, trunco 8-12-pedali annulato vel aspero, petiolis per totam longitudinem armatis, lamina orbiculari-reniformi, pinnis sub 18, lateralibus oblique præmorsis 3-4-lobis obtuse bipartitis, terminali 10-11-lobo, intermediis 3-5-lobis

lobis obtuse bifidis, spadice foliorum circiter longitudine, ramis 3-7 spicigeris, spicis subulatis pubescentibus, floribus bi-ternatis extus pubescentibus, calyce ovato ad medium rotundate tripartito, bacca obovato-oblonga.

Licuala spinosa, *Willd.* 2. *p.* 201. (excl. syn. Rumph.) *Roxb. Fl. Ind.* 2. *p.* 181? (excl. syn. Rumph. et Lam.) *Syst. Veg. ed. Sch.* 2. *p.* 1301. *Mart. Palm. p.* 235. *t.* 135. I. II.

HAB.—Common in wet places, particularly in hedges, Malacca. Malayan name, *Plass.* Cultivated in the H. C. Botanic Garden, where it flowers in the cold and ripens its fruit in the hot season.

DESCR.—A stout Palm, 10-12 feet high, forming dense tufts. *Trunk* 2-4 inches in diameter, 8-10 feet high, marked with the scars of the fallen petioles. *Leaves* 6-7 feet long. *Petiole* about 4-4½ feet long, obtusely trigonal, margins armed throughout with stout conical somewhat curved aculei. *Lamina* in outline orbicularly reniform, about 4 feet across the broad diameter; pinnæ about 18, narrow cuneate; central ones about 2 feet long; terminal one 10-11 plicate, truncate, with as many lobes as plaits, the lateral ones the deepest, all obtusely bifid; the intermediate more or less truncate, 3-5 lobed, lobes larger and deeper, but otherwise similar to those of the terminal one, the lateral with oblique 3-lobed ends. *Ligula* very narrow, 1-1½ inch long, scarious.

Spadix a little longer than the leaves, branches 7-10, adnate to the axis as high as the points of the spathes. *Spathes* green, sprinkled with brownish scurf, with scarious lacerated ends, occasionally obliquely lacerated. *Spikes* to the lower branches several, stout, subulate, downy, spreading, generally secund.

Flowers sessile, in two's or three's, small, nearly ovate. *Calyx* subovate, divided to the middle into three rounded teeth. *Corolla* a little longer than the calyx, divided below the middle into three broad lanceolate, acuminate segments. *Annulus* rather high, nearly entire. *Filaments* (free,) short, setaceous. *Anthers* oblong-ovate. *Ovarium* depressed, turbinate, sculptured at the apex. *Style* filiform, rather longer than the ovary.

Fruit as though stalked by the cylindrical tube of the calyx, surrounded at the base by the perianth, oblong, red, one-seeded. *Seed* ovate, intrant process curved towards the middle of the dorsum. *Albumen* horny, on a transverse section horse-shoe-shaped. *Embryo* about central.

This species appears to vary a good deal; it is not improbable that two species lurk under this name. Some of my Malacca specimens have the trunk armed with the hardened bases of the petioles, slenderer spadices and considerably smaller fruit.

It approaches in the leaves to L. peltata, especially in the division of the ends of the pinnæ, but it is otherwise obviously distinct; it is the only species I know that forms tufts. Its nearest affinity is with L. paludosa.

Rumph's figure* (Hb. Amb. 1. t. 9.) quoted for this appears to me to be a distinct species, particularly as regards the spathes and the erect simple spikes.

55. (2) L. *paludosa*, (n. sp.) trunco sub-lævi 8-12-pedali, petiolis apice inermibus, lamina flabelliformi, pinnis 7-9, lateralibus apice obliquis profunde et acute 3-4 lobis, lobis bipartitis, reliquis truncatis lobis 4-5, (vel terminali 7-8) latis brevibus bifidis, spadice foliorum circiter longitudine, ramis spicas plures nutantes secundas gerentibus, floribus glabris solitariis turbinatis, calyce cyathiformi integriusculo corolla sub-duplo breviore, ovario depresso-turbinato.

Hab.—Low sandy wet places along the sea-coast, about Tanjong Cling, Koondoor, and Pulo Bissar, Malacca; associated with Pandanus, Eugenia, Diospyros, Helospora, etc. In flower February, 1842.

Descr.—*Trunk* 8-12 feet high, about $1\frac{1}{2}$ inch in diameter, unarmed and almost without marks of annuli, except towards the apex

* See Mart. Palm. p. 236. adnot. where the name L. Rumphii is proposed for this species.

where they are incomplete. *Crown* moderate. *Rete* of rather stout, rich brown fibres. *Ligula* linear, one inch long, gradually attenuate towards the apex. *Petiole* 1¼-1½ foot long, subtrigonal, armed along the margins, except towards the apex, with small, black, horny, conical, curved teeth. *Lamina* flabelliform, rather smaller than that of L. spinosa; *pinnæ* 8-10, cuneate, lateral ones oblique at the apex, deeply and acutely 3-4 lobed, lobes bilobed (except the side ones,) the others more or less truncate with 4, (or as in the terminal 5-8,) broad, short, bifid lobes.

Spadix about the same length as the leaves, rather curved. *Spathes* tubular, green, with membranous or scarious lacerated mouths. *Branches* of the spadix bearing 5-7 spikes, which are 4-6 inches long, curved, secund, generally nodding, slightly puberulous, often appearing as if they arose separately from within the mouth of the spathe.

Flowers solitary, sessile, of a turbinate form, smaller than usual. *Calyx* cup-shaped, half the length of the corolla, nearly entire, irregularly split at the expansion of the flower. *Corolla* (in bud) urceolate, about one-third longer than the calyx, divided to the middle into three, cordate ovate segments. *Annulus* of the *stamina* white, nearly entire, projecting considerably above the faux of the corolla. *Filaments* (free) short, setiform. *Anthers* versatile, oblong, pale brown. *Ovarium* depressed, turbinate, with a horny sculptured vertex; carpels adhering by the style. *Ovula* solitary, erect, anatropous. *Style* subulate, rather shorter than the ovarium. *Stigma* simple. *Fruit* not seen.

This species approaches to L. spinosa, but is abundantly distinct by its smooth stem, which does not look much like the stem of a palm, and by the short smooth turbinate flowers.

The tracts of country in which it is found, form one of the peculiar marks of the Straits' Flora, and are highly contrasted with the muddy littoral tracts, which are covered as usual with Mangrove jungle.

56. (3) L. *peltata*, trunco robusto 3-4 pedali, petiolis per totam longitudinem armatis, lamina orbiculari-peltata, pinnis

18-20, lateralibus apice obliquis profunde et acute 3-5 lobis, lobis bipartitis, reliquis truncatis plurilobatis, lobis obtuse bifidis, spadice foliorum circiter longitudine, spicis simplicibus pendulis secundis pubescentibus, floribus solitariis (maximis) extus pubescentibus, annulo staminum nullo, ovario depresso turbinato stylo triplo breviore, bacca obovata, processu intrante sursum latissima obliqua, embryone infra medium seminis.

Licuala peltata. *Roxb. Fl. Ind. 2. p. 179. Icones. Suppt. 3. t. 79. Hamilton Comm. Herb. Amb. in Mem. Wern. Soc. 5. p. 313. Mart. Palm. p. 234. t. 162.*

HAB.—Woody mountainous country to the eastward of and near Chittagong, *Roxburgh;* Mountains beyond the Ganges; Rungpore, *Buchanan;* Assam, *Major Jenkins;* Himalayan range, below Darjeeling, *Seharunpore Collectors.* Cultivated in H. C. Bot. Gardens, flowering in the cold season, fruiting in the hot season. *Kurup, Kurkuti.* Bengally. *Chattah Pat.* Assamese.

DESCR.*—A low Palm, with a stout stem 3-4 feet high, marked below with the scars of the fallen leaves, above rough from the persistent bases of the petioles. *Leaves* 8-10 feet long. *Rete* copious. *Petiole* 6-7 feet long, triangular, armed throughout along the margins, especially towards the base, with stout, horny, black, very sharp, conical, rather curved thorns. *Ligula* cordate, when young the margin is very elevated and tomentose. *Lamina* peltate; *pinnæ* about 18-20, describing nearly a circle of about 6 feet in diameter, about 3 feet 3 inches long, outermost ones cuneate-oblong, 3-5 plaited, 3-5 lobed, lobes acutely bilobed, with oblique ends; intermediate and terminal much broader, 7-8 inches across, truncate, with several plaits and as many less deep, broader, rather obtuse, bifid lobes.

* From plants in the Botanic Gardens. Entire specimens since received from Major Jenkins have the stem 3½-4 feet high, rough from the persistent, distant bases of the petioles; the leaves 12-14 feet in length; the petioles 8-9 feet and armed throughout. The spadices equal the leaves.

Spadix erect, rather longer than the leaves, stout, simply branched, sprinkled in the upper parts with brown scurf. *Spathes* tubular, green, lower ones a foot or nearly two feet long, bilobed at the apex, at length variously split, similarly scurfy. *Spikes* 3-5, solitary, nodding-pendulous, secund, centrifugally developed, a foot (or more) long, pubescent, adnate to the axis to about the middle of the spathe.

Flowers numerous, on short stalks, solitary, very large, 7 lines long, of a greenish white-colour, covered externally with the same pubescence as the spike, opening centrifugally. *Calyx* with a funnel-shaped or obconical tube, shortly 3-toothed. *Corolla* twice as long as the calyx, divided to the calyx into three broadly lanceolate, coriaceous, reflexed segments. *Filaments* united among each other and to the corolla as far as the base of its segments, thence free, long, stout, plano-subulate, keeled along the back. *Anthers* linear, sagittate, exserted, attached near the middle; otherwise the cells are nearly distinct.

Ovarium turbinate, short, with a sculptured depressed apex; carpels cohering by their apices. *Ovula* solitary, erect, anatropous. *Style* filiform, slender, three times longer than the ovarium. *Stigma* obsoletely 3-toothed, on a level with the anthers.

Fruit obovate, oblong, attenuate to the base, red, 1-seeded, apiculate by base of style, and crowned with the 2 abortive carpels, surrounded at the base by the perianth, the tube of the calyx resembling a short pedicel. *Seed* oblong; excavation passing in above the hilum, oblique, reaching nearly to the apex of the seed, dilated upwards. *Albumen* horny. *Embryo* below the middle.

This, which is the largest and finest species of the genus, is not likely to be confounded with any other. Its large peltate orbicular leaves, simple large pendulous spikes, and comparatively very large flowers, will at once distinguish it. In the leaves it is allied to L. longipes, but that species is almost stemless, the leaves are also dark green, and differently lobed. Martius's figure of the entire plant gives a much better idea of L. spinosa than of this species.

Major Jenkins informs me, "the leaves of the Chattah Pat are used for the same purposes as those of the Toko, but are much coarser, and only made use of by the lower orders. The demand for them is very great, scarcely a single ploughman, cow-keeper or cooly but has his Jhapee or Chattah made of Chattah Pat."

57. (4) L. *acutifida*, trunco gracili, foliis flabelliformibus, pinnis 15-20 subæquilatis anguste cuneatis tricarinatis, lateralibus apice obliquis inæqualiter 3-4-lobis, terminali 4-5-lobo, intermediis trilobis lobulis (lateralibus exceptis) bipartitis sinubus acutis, spadice folia subæquante cum spicis floribusque fusco-pubescenti-hirto, ramis simplicibus vel bipartitis, spathis bilobis sericeo argenteove paleaceis, floribus inferioribus binatis superioribus solitariis, petalis calyce obconico ad medium tripartito longioribus, seminis pisiformis processu intrante cylindraceo rectiusculo.

L. acutifida, *Mart. Palm. p.* 237. *t.* 135, iii. iv. (excl. syn. Roxb.)

Hab.—Penang, whence I have specimens from Mr. Lewes, and Dr. Oxley. Malayan name *Plass tikooss.*

Descr.*—A small miniature Palm. *Trunk* 3-5 feet high, (sometimes 15-20 feet, *Mr. Lewes*), 10-11 lines in diameter, about 22 lines in diameter at the base, marked with incomplete rings, to which portions of the base of the petioles adhere.

Petioles in some of the specimens $3\frac{1}{2}$-4 feet long, in others (and this seems the natural state) scarcely 18 inches long, plano-convex, armed towards the base along the margins with tooth-shaped, straight or sub-deflexed short prickles. *Rete* brown, copious, produced upwards into a long brown membranous ligula. *Pinnæ* 15-20, disposed in a subpeltate manner, generally linear-cuneate,

* Specimens, three entire small plants and several specimens of inflorescence and a few ripe seeds.

10-11 inches long, 8 lines broad; the intermediate ones the narrowest, unequally 3-4 lobed; the others 3-lobed, the central lobe deeply bipartite; the central pinnæ 4-5 lobed, (the inner lobes deeply bipartite, the lateral ones entire.) Between the lobes threads are often to be found.

Spadices 12-18 inches long, nodding, covered below with greyish, above with ferruginous pubescence, rather stouter towards the apex. *Spathes* tubular with oblique mouths, covered with grey silvery adpressed hairs or rather paleæ; limbs more or less lanceolar, bilobed, lobes ending in acuminate scarious points; the second spathe nearly 6 inches long. *Spikes* generally simple, rarely dichotomous, adnate to the peduncle very high up, subulate, densely covered with tawny pubescence; the lowest 5 inches long.

Flowers numerous, sessile, spreading in every direction, articulated on short stalks, lowermost in pairs, upper ones solitary. *Calyx* obconical, trifid to the middle, tawny pubescent; segments obtuse. *Corolla* ⅓ longer than the calyx, similarly pubescent externally, furrowed internally, tripartite to the middle, segments half lanceolate acute. *Annulus* of the *stamens* 6-toothed. *Filaments* (free) short, setaceous from a broad base. *Anthers* oblong. *Ovarium* smooth, sculptured at the apex, obovate-oblong, about the length of the tube of the corolla, of three carpella, cohering by their apices: *ovüla* solitary, erect, anatropous. *Style* about equalling the stamina, filiform, three-sulcate. *Stigma* obsoletely cup-shaped, obscurely 3-denticulate.

Fruit about the size of a large pea, roundish-oblong, surrounded at the base by the flattened-out limb of the perianth, and as it were stalked by the tube of the same, dry. *Seed* pisiform, tinged with reddish; teguments very thin, adhering firmly to the albumen; from the hilum enters a deep process, so that it is horse-shoe shaped on a longitudinal section. *Albumen* horny, equal. *Embryo* subcentral.

Obs.—The stems of this plant afford the well known walking-sticks known by the name of "Penang Lawyers." These are prepared by scraping with glass, and polishing. Mr. Lewes informs me, "Each stem is well-scraped, by which

the epidermis is altogether removed; care must be taken not to take away much more, as the inside is like the substance of a rattan. It is on this account that the smaller, thinner sticks are so much sought for, and are so rare. The sticks are then straitened by fire. No other process is used."

The plant seems to be confined within narrow geographical limits; it is not known I believe about Malacca, where its place seems supplied by the following closely allied species. Martius, however, states it to be found throughout the Malayan peninsula.

I have an impression that under this species as given by Martius, two distinct ones will be found; for though the description agrees well with my Penang specimens, yet the drawing of the spadix represents the parts nearly of the same size as in L. spinosa.

L. pumila, Blume, appears only to be distinguished from this by the broader equal teeth of the pinnæ, the intermediate ones of which are the broadest, being described as 16-21 lines broad and 6-8-toothed, while the two innermost ones are said to be only an inch broad.*

58. (5) L. *glabra*, (n. sp.) trunco gracili 3-5 pedali, foliis flabelliformibus, pinnis 16 subæquilatis lineari-cuneatis tricarinatis, lateralibus apice 3-4-lobis dentatisve, terminali 4-lobo, intermediis trilobis lobis (lateralibus exceptis) obtusissimis bipartitis sinubus latis, spadice folia subæquante cum spathis spicis floribusque glabro, ramis 3-5-partitis, spicis gracilibus, floribus inferioribus binatis, calyce cyathiformi brevissime tridentato, corolla triplo longiore infra medium tripartita, ovariis usque ad medium cohærentibus.

Hab.—Solitary on Goonong Miring, an offset of Mount Ophir. Flowers in February. Malayan name, *Plass Goonoong.*

* Syst. Veg. ed. Sch. 7, 2. p. 130.

DESCR.—A miniature Palm. *Trunk* 3-5 feet high, rather slenderer than that of the preceding. *Petiole, rete* and *ligula* much the same as those of the preceding. *Lamina* of the same size as the preceding, flabelliform; *pinnæ* about 16, linear-cuneate, tricarinate, the lateral ones obliquely and unequally 3-4 toothed or lobed, the central one 4-lobed, the two inner lobes bifid, the rest 3-lobed with the central lobe bifid; all the divisions obtuse.

Spadices about equalling the leaves, in some of the specimens 3 feet long, nodding, quite smooth, as are the spathes, which have acutely bipartite points. *Branches* distant, adnate to the spadix high up. *Spikes* several on one branch (except the uppermost ones), quite smooth, slender, 2-3 inches long, spreading.

Flowers also smooth, rather distant, on short articulated stalks; lower ones in pairs. *Calyx* cup-shaped, with three very short teeth. *Corolla* deeply tripartite, three times longer than the calyx, segments linear lanceolate. *Filaments* (free) subulate from a broad base, rather long. *Anthers* ovate. *Pollen* ovate, 1-plicate. *Ovarium* obovate oblong, of three carpella adhering nearly to the middle. *Ovula* solitary, erect, anatropous. *Style* filiform, rather shorter than the ovarium. *Stigma* subsimple.

Fruit about the same size as that of L. acutifida, but obovate. *Seed* of the same shape, the intrant process is rather larger than in the preceding.

I first met with this on Mount Ophir; subsequently I have received specimens from the same locality from my collector E. Fernandez. It is closely allied to the preceding, (Penang Lawyer,) from which indeed the leaves are scarcely distinguishable, except by the broad sinuses of the lobes and their more obtuse points. The smooth inflorescence and flowers, however, at once distinguish it from both that species and L. pumila, Blume. I am not aware of its stems being used for walking sticks.

59. (6) L. *longipes*, (n. sp.) subacaulis, petiolis (4-5 pedalibus) triquetris apicem versus inermibus, lamina orbiculari-

peltata (atroviridi,) pinnis circiter 20 cuneatis, lateralibus oblique truncatis 3-4-dentatis, terminali latiore truncata sub 11-dentata, dentibus omnibus bifidis et irregulariter denticulatis, spadice erecto petiolis multo breviore thyrsoideo-ramoso, spicis (ramorum pluribus) undique patentibus, floribus solitariis numerosis parce pilosis, calycis cylindracei dentibus rotundatis bifidis, ovario medium supra fusco-villoso.

HAB.—Solitary in dense forests, Ayer Punnus (Rhim) and Goonoong Miring, Mount Ophir, but not above an elevation of 1000 feet. Forests near Lainear, to the south of Mergui. Flowers nearly all the year. *Plass Bhatto* of the Malays.

DESCR.—A nearly stemless Palm, otherwise of considerable size, with dark green peltate leaves. *Leaves* 5-7 feet long. *Rete* of stout leathery fibres. *Petioles* stout, 4-5 feet long, rather obtusely triquetrous, armed (except the upper third) along the two inner angles with stout, horny, conical, tooth-shaped prickles. *Lamina* 2-2¼ feet long, 3-4 feet broad, peltate-flabelliform; *pinnæ* 20-22, the lateral ones narrowest, obliquely cut off, unequally 3-4-lobed, lobes irregularly denticulate; the terminal one cuneate, 5 inches broad, truncate, 11-keeled above, with as many short, truncate, broad, bifid, denticulate lobes as keels: intermediate ones narrower, generally 3-keeled, otherwise similar: upper margins of all blackish-brown.

Spadix stout, much branched, much shorter than the leaves, 1½-3 feet long, erect, undulate, flexuose. *Spathes* compressed, lax, almost inflated, laceroso-fibrous at the ends, when young grey from a covering of cellular paleaceous cellules. *Branches* adnate to the peduncle high up, bearing many spreading, subulate, scurfy-pubescent spikes, 3-5 inches long.

Flowers numerous, sessile, green, slightly hairy outside. *Calyx* subcylindrical, 3-toothed, teeth bifid! *Corolla* almost twice as long as the calyx, divided to a little below the middle into three broad, cordate, lanceolate segments. *Annulus* of the *stamina* subtruncate, projecting considerably above the faux of the corolla. *Filaments* (free) short, setiform. *Anthers* cordato-ovate, slightly inflexed. *Ova-*

rium turbinate, toward the base smooth and tripartible, above entire and covered with fuscous villi. *Ovula* solitary, erect, anatropous. *Style* cylindric, rather shorter than the ovarium, hollow at the apex. *Stigmata* three, minute, on a level with the annulus.

Fruit (immature) subbaccate, sitting on the stout pedicel-like tube of the calyx: surrounded at the base by the perianth, and annulus, apiculate by the style, one seeded. *Endocarp* thin, subosseous.

This, judging from Schultes' description,* appears to be somewhat allied to Blume's L. ramosa, quoted by Martius under L. spinosa.

It is very distinct from the other species known to me by its inflorescence, which is so divided and short as to be almost a thyrsiform panicle, its short trunk but otherwise large stature, and dark leaves, in the orbicular spreading of the divisions of which it resembles L. peltata.

60. (7.) L. *triphylla*, (n. sp.) nana, subacaulis, pinnis tribus pluridentatis (dentibus marginali excepto emarginatis), lateralibus oblique cuneatis præmorsis, terminali abrupte præmorsa, spadice foliis breviori vix spithamaeo, floribus paucis solitariis, fructibus pisiformibus processu intranti curvato.

Hab.—In dense forests, Ayer Punnus, (Rhim,) Malacca. Only one specimen was procured.

Descr.—A very dwarf Palm, the whole height not exceeding 2½ feet; the *stem* being about 3-4 inches long. *Leaves* 1-2 feet long. *Petioles* plano-convex or canaliculate, armed below the middle with straight or somewhat hooked, deflexed, rather long prickles. *Rete* well developed. *Lamina* of three cuneate *pinnæ*, the lateral ones obliquely præmorse, the terminal (which is 5-6 inches long, 2½ wide) truncate: as many short teeth as there are carinæ; all

* Syst. Veg. ed Schultes.

except the lateral one on either side emarginate; those of the terminal one being the shortest and about 12 in number.

Spadix (fruit-bearing) nodding, cernuous, scarcely a span long, smooth, except the spike bearing part, which is scurfy-pubescent. *Spathes* smooth, bipartite. *Branches* four, lowermost dichotomous. *Spikes* about an inch long, marked with the scars of a few flowers. *Berries* about 5 on the largest spike, sub-distichous, red, the size of a pea, seated as it were on a short stout stalk (the tube of the calyx,) and surrounded at the base by the spreading cordate-ovate acuminate segments. *Seed* like a small pea. *Intrant process* curved, so that its upper part becomes nearly horizontal. *Embryo* subcentral.

The stature and leaves of this will at once distinguish it. In the teeth of the pinnæ it approaches L. pumila, and especially L. longipes.

It appears to be distinguishable from very young plants of L. spinosa by the longer petioles, and less deeply toothed pinnæ. The perianthium also does not appear to be pubescent, and the fruit is pisiform.

LIVISTONA.

R. Br. Prod. Fl. Nov. Holl. ed. 2da. 123. *Syst. Veget. ed. Schult.* 7. *No.* 1491. *p.* 1307. *Mart. Progr. Palmar. p.* 10. *Palm.* 102 (part. sub nom. Coryphae rotundifoliae) 109, (part) 110, 111, 135, 145, 146. *Endl. Gen. Pl. p.* 252. *No.* 1754.

Livistonia, *Gen. Pl. ed. Spreng. p.* 283. *No.* 1465.
Saribus. *Rumph. Hb. Amb.* 1. *t.* 8.

Char. Gen.—*Flores* hermaphroditi. *Perianthium* utrumque tripartitum. *Stamina* 6, filamentis e corolla liberifactis distinctis, (basi dilatatis). *Ovaria* 3, apice cohærentia. *Styli* connati. *Stigma* subsimplex. *Drupa* (unica maturescens) monosperma. *Albumen* cavitate ventrali. *Embryo* dorsalis.

Habitus.—Palmæ *Asiae orientalis et australis, saepius arboreae, perennantes.* Foliorum petioli *saepius armati;* laminæ *segmenta profunde bipartita, interdum acuminatissima pendula, lateralia longiora.* Rete *copiosum.* Spadices *axillares, paniculatim ramosi; pedunculis* spathis *vaginantibus obtectis.* Flores *minuti, albidi, glomerulati.* Drupæ *saepius inaequilaterales, glaucescenti-azureae.*

Discrimina vera inter Licualam et hoc genus ponuntur, tantum in foliis palmatim flabelliformibus, filamentis in annulum liberum vix coalitis et baccis azureis. Fructus structura in utroque eadem.

61. (1) L. *Jenkinsiana,* (n. sp.) 20-30-pedalis, petiolis pertotam fere longitudinem armatis, lamina (foliorum) reniformi-flabelliformi diametro extremo 5-6 pedali subtus glauco pruinosa, segmentis 75-80 obtuse bilobis, lateralibus sub-1½ pedalibus centralibus duplo longioribus, calyce rotunde et membranaceim 3-dentato, fructibus subreniformi-rotundis magnitudine globuli sclopeti.

Hab.—Gubro Pùrbut, Upper Assam, in flower March 1836. Common throughout Assam, but most plentiful in the Nowgong district, *Major Jenkins.* *Toko Pat* of the Assamese.

Descr.*—A Palm 20-30 feet high, with a thick round crown. *Trunk* in diameter 6-7 inches, rough towards the apex from the adhering bases of the petioles. *Leaves* 6-7 feet long. *Petiole* channelled above, armed almost to the summit; *ligula* cordate. *Lamina* reniform-flabelliform, greatest breadth 5-6 feet, length from the apex of the petiole 3-3½ feet, divided into about 76-80, obtuse, bi-lobed segments, of which the extreme lateral ones are the deepest, being 18-inches long, while the central ones are scarcely half that length,

* Partly from living plants observed at Gubroo, partly from specimens received from Major Jenkins.

under surface glaucous cæsious. The outline of the undivided part is almost exactly cordate.

Spadices axillary, 2-3 feet long; branches a span or a foot long, dichotomous opposite the ends of the spathes; branchlets (spikes) lowermost 2 or 3 times divided, the others simple. *Spathes* chesnut red, sometimes split, concealing the greater part of the peduncle; scurfy outside, the one next the first branch 1½ foot long, 3-5 keeled, with a large, oblong, deeply bilobed, split limb.

Spikes to each branch many, 4-6 inches long, spreading, rather stout. *Flowers* several together, sessile on small knobs, small, greenish, without bracteæ *Alabastra* oblong. *Calyx* short, with a broad as it were lobed base, cup-shaped, with three short rounded teeth with membranous margins. *Corolla* about twice as long as the calyx, divided to a short distance from the middle into three triangular segments. *Stamina* 6, united as usual. *Filaments* free (at the faux,) short, setaceous from a very dilated base. *Anthers* oblong, versatile. *Pollen* lanceolar, with one fold. *Ovarium* obconical, yellow, with a depressed, red spotted, somewhat sculptured apex; *carpels* cohering by means of the short trisulcate filiform style. *Stigma* simple. *Ovula* solitary, erect, anatropous.

Drupe reniform, round, slightly attenuate at the base, the size of a musket ball, of a leaden blue colour, marked on one side, with a depressed whitish line. *Seed* erect, presenting on the side corresponding with the above line on the fruit a broad raphe-like line. *Albumen* horny, opposite the centre of the above line deeply excavated; cavity as usual filled with a spongy substance. *Embryo* opposite the excavation or in the centre of the dorsal face.

It appears to be quite distinct from any published species. The fruit is larger than in any other.

Major Jenkins tells me: "This palm is an indispensable accompaniment of every native gentleman's house, but in some parts it is rare, and the trees are then of great value. I cannot call to my recollection having ever seen a Toko tree undoubtedly wild. The leaves are in universal use throughout Assam for covering the tops of doolees, (pal-

kees,) and the roofs of khel boats, also for making the peculiar hats, or rather umbrella-hats (jhapees) of the Assamese. For all these purposes the leaves are admirably adapted from their lightness, toughness, and durability."

It has been therefore deemed not inappropriate to connect with it the name of the present Commissioner of Assam, whose name is so honourably and inseparably connected with that of the Province under his controul. To this constant contributor the Botanic gardens are indebted for a number of seeds, now vegetating, and for a number of young plants.

62. (2) L. *spectabilis*, (n. sp.) procera, petiolis per totam longitudinem armatis, foliis orbiculari-peltatis, diametro extremo 9-10-pedali, segmentis circiter 90 profunde bipartitis, laciniis in filis longis pendulis acuminatissimis, calyce ad medium tripartito, baccis subrotundis globuli sclopeti minoris magnitudine.

Hab.—Solitary in the low littoral tracts, adapted to rice cultivation, Malacca. Penang. *Mr. Lewes*. Malayan name. *Sardang*.

Descr.—A lofty palm, 50-60 feet high. *Trunk* smooth or armed towards the base with the hard persistent bases of the petioles. *Crown* ample, round. *Petioles* obtusely triangular, armed along the margins with very stout, conical, subulate, compressed, generally recurved thorns. *Lamina* orbiculari-peltate, 9-10 feet across, plaited deeply, divided into about 90 divisions. These are ensiform, deeply bi-lobed, the segments being gradually acuminated into flat pendulous threads. The central divisions reach to 2 feet from apex of the petiole, while the outer ones reach almost to the petiole itself. The length of their segments is 2¼-3 feet, those of the central divisions extending to about a foot from the base.*

* The long diameter of the leaf is about 6 feet, the cross diameter about 8 feet. The lateral divisions almost reach to the base, and their secondaries again do the same, about 4 feet long. The intermediate reach to about 1¼ foot from the base,

Spadices axillary, 4-5 feet long, alternately branched, nodding. *Branches* 1-1½ foot long, spreading, dichotomous at the mouths of the spathes, much divided into forked or simple spreading branchlets (spikes), 6-10 inches long. *Spathes* coriaceous, fuscous or chesnut coloured, concealing the whole peduncle, with erect adpressed acuminate limbs; the lower ones generally more or less reticulately split.

Flowers sessile, the lower ones several together, upper solitary. *Calyx* minute, cup-shaped from a broad base, divided to the middle into three round teeth. *Corolla* (in bud) depressed, a little longer than the calyx, divided nearly to the base into three broad segments. *Stamina* 6; *filaments* united to the corolla as far as the base of the segments, there (free) short, dilated. *Anthers* oblong-ovate or cordate-ovate. *Ovarium* oblong-obturbinate, sculptured at the apex, the three carpels cohering by the style, which is trisulcate, filiform, about three times shorter than the ovarium. *Ovula* solitary, erect, anatropous.

Spadix of the fruit nodding, otherwise unchanged, branchlets subsecund, yellowish. *Berry* globose, of the size of a small bullet, nearly dry, of an azure blue; smooth, somewhat oblique, surrounded at the base by the perianthium. *Endocarp* thickish, subosseous. *Seed* with a large cavity filled with the tegument. *Embryo* central.

Although the vernacular name given by Blume for L. rotundifolia is the same, and the fruit agrees well with the figure of Martius, yet there are so many discrepancies in his description, as regards the arming of the petiole, the degree of acumination of the segments of the leaves, which is described as less than in L. sinensis, and their general size, that I am compelled to consider this distinct.

Rumph's figure, quoted by Blume and Martius under L. rotundifolia, gives no idea of the habit except as regards the fruit-bearing spadix. And I do not think it probable that the retrofracted pendulous divisions of the leaves, for which this

are 4½ feet long, the secondary divisions about 3 feet long. The central divisions reach to about 3 feet from the apex of the petiole, are 3-3½ feet long, their secondary divisions 3 feet long, and even more acuminate and filiform than the rest.

species is more remarkable than perhaps any other,* would have escaped Rumph altogether. F. Bauer's beautiful figure† of L. inermis gives, excepting as regards the pendulous segments of the leaves and annulation of the trunk, a good idea of the habit of this Palm. I am not aware of its being applied to any use.

CHAMÆROPS.

Linn. Mus. Cliff. p. 10. *Gen. Pl. ed. 6ta.* 1764. *p.* 571. *No.* 1219. *ed. Schreb. p.* 772. *No.* 1688. *Jussieu. Gen. p.* 39. *Lam. Enc.* 4. *p.* 709. (*Palmiers*) *t.* 900. *Syst. Pl. ed. Schultes.* 2. *p.* XCIII. 1488. *Endl. Gen. p.* 253. *No.* 1759. *Mart. Progr. p.* 9. *Palm. p.* 247. *t.* 120. 124-5. *Pl. As. Rar.* 3. *t.* 211. *Andrews. Bot. Rep. t.* 599. *Bot. Mag. t.* 2152. *Lambt. in Linn. Trans.* 10. *t.* 8.

Chamæriphes. *Gaertn. Fruct. et. Sem.* 1. *p.* 25. *t.* 9.

CHAR. GEN.—*Flores* polygamo-mono-dioici. *Calyx* tripartitus. *Corolla* tripetala v. tripartita. *Stamina* 6-9, filamentis

* L. *sinensis*, 20 pedalis, petiolis inermibus, foliorum lamina reniformi-flabelliformi diametro 5-pedali, segments 80-85 ad medium bipartitis subulato-acuminatissimis pendulis, fructibus subolivæformibus inæquilateralibus.

L. sinensis, *Mart. Palm. p.* 240. *t.* 146, I-II.

HAB.—Southern China, Martius. Cultivated in these gardens under the name Livistonia? Mauritiana; said to have been introduced from the Mauritius in 1821.

The largest specimen is 20-25 feet high, with a stout obscurely annulated trunk. *Crown* round. *Leaves* much plicate, and also conduplicate along the centre, the lateral segments which are much the narrowest 2 feet or 2-2 inches long, their divisions about a foot long. *Spadices* smaller, but otherwise much like those of L. spectabilis. *Flowers* white, of an unpleasant smell, generally 4 together. *Calyx* with three rounded teeth with membranous margins. *Corolla* longer than the calyx, divided below the middle into three cordate erect segments. *Fruit-bearing Spadix* nodding, with subsecund branches. *Berries* dull blue, oblong, 7 lines long, and 4½ wide. *Seed* oblong, of a greyish colour, on a longitudinal section reniform, intrant process subcentral. *Embryo* opposite to this, a little below the centre of the dorsal face, looking downwards.

This approaches in the acuminated pendulous segments of the leaves to L. spectabilis, but otherwise is quite distinct. It is not mentioned in the Hortus Mauritianus. A. D. 1837.

† Mart. Palm, t. 145.

basi coalitis. *Ovaria* tria. *Styli* 0. *Baccae* 1-3, monospermæ. *Semen* in facie ventrali sulcatum, æquabile vel ruminato-variegatum. *Embryo* dorsalis.

HABITUS.—Palmæ *perennantes, frutescentes vel arboreae, nanae vel procerae.* Rete *saepius amplum.* Petioli *margine denticulati, vel spinosi, vel sublaeves.* Lamina *palmatim multipartita;* laciniæ *induplicatae, apice saepissime bilobae, filis intermediis saepius nullis.* Spadices *simpliciter aut composito-ramosi.* Spathæ *coriaceae, tubulosae, rameae paucae vel deficientes.* Flores *flavescentes, bracteati.* Filamenta *basi connata.* Baccæ *carne spissa parca, olivaeformes vel subrotundae.*

"Numerus partium haud raro auctus; loco ternarii quaternarius, quinarius vel senarius."

Affinitate proxima Livistonæ. Præbet transitum ad Phænicem per flores polygamos, staminum numerum auctum, baccas et structura seminis.

63. (1.) C. *Martiana*, trunco elato, frondium vagina cylindrica reticulata, petiolis margine leviter dentatis et supra paleis albis furfuraceis, lamina reniformi subtus glauca, laciniis 70-75 conduplicato-canaliculatis, segmentis apice bifidis, spathis partialibus pluribus, baccis olivæformibus lepidotis (flavescentibus).

C. Martiana, *Wall.* (sine charactere!*). *Mart. in Pl. As. Rar. 3. p. 5. t.* 211.

* The describer and investigator of the affinities of any undescribed plant is the proper person to name it. Working botanists should pay no attention whatever to those persons who insist on attaching their initials to objects they will not, or cannot, describe and elucidate. It was originally intended that the initials attached to the name of a species should be those of the botanist who first defined it, but now owing to flattery, indolence, incapacity and MSS. names, this very requisite signification is in a considerable measure lost. Some stringent rule is much required, for the present it may be sufficient to attach *sine charactere!* to all initials that fall under the above mischievous paradox.

HAB.—Bunipa in the great valley of Nipal, at an elevation of about 5000 feet above the level of the sea. Newar name, *Tuggu.* (Wallich.)

DESCR.*—*Trunk* 20 feet high, irregularly annulate, of irregular diameter. *Crown* hæmisphærical, rather thin. *Leaves* 5 feet long. *Petioles* 2½-3 feet long, unarmed, generally partly twisted. *Lamina* reniform-orbicular or almost orbicular, concave, (rarely convex) 2 feet 2 inches long, about 4 feet broad; laciniæ about 75, conduplicato-canaliculate, glaucous underneath, with nodding ends; the central ones the broadest, about 16 inches long, obtusely bilobed to the depth of ½ or 1 inch; lateral ones about a foot long, linear acuminate, very narrow, acutely bilobed; intermediate ones 16 inches long, and acutely bilobed.

Spadices 3-5 feet long, very much branched; furnished at the base (and under each primary branch) with spathes: peduncle about a foot long. Lowermost *spathe* 1-1½ foot long, two-edged, semi-bifid at the apex: the third or fourth suffults a flower-bearing branch. *Spikes* 1-1½ inch long. *Flowers* minute, solitary or in pairs: at the base of each a minute membranaceous bracte. *Calyx* trifid; laciniæ ovato-triangular, sub-obtuse. *Petals* three times larger than the calyx, ovato-orbicular, erecto-patent. *Stamina* as long as the corolla. *Anthers* linear-oblong. *Ovaria* 3, ovate, covered with a silky wool: the fertile ones have very short styles terminated by a capitate stigma: the barren ones have longer styles without any stigma. *Berries* shaped like an olive, but twice as small, furrowed slightly along on one side: yellowish, sprinkled with adpressed dry squamules. *Seed* erect, of the size of a coffee seed: ventral face with a depression, filled with cellular substance; dorsal convex. *Albumen* cartilaginous-horny, horse-shoe-shaped on a transverse section. *Embryo* at the centre of the dorsal face.

This elegant Palm thrives tolerably well in the H. C. gardens in shady raised spots. The figure in the Pl. As. Rar. (*loc. cit.*) *improved* from a native drawing of a garden specimen

* From living plants in the H. C. Botanic Gardens, inflorescence and fruit chiefly from Martius, Palm. loc. cit.

does not give a good idea of the crown of the garden specimens, being too large and too thick, and without any old leaves hanging down. The representation of the inflorescence is probably quite wrong.

64. (2.) C. *khasyana*, (n. sp.) trunco mediocri, petiolis per totam longitudinem denticulato-scabris, fibrillitio e fibris erectis regidiusculis, lamina reniformi-flabelliformi profunde 60-65 partita, laciniis induplicatis bilobis vel bipartitis lobis centralium brevibus obtusis recurvis, spadice (fructus) bipedali, ramis primariis tribus, spathis subternis, (basilaribus 2 rameo 1,) pedunculum communem omnino tegentibus, fructibus oblongis livido-cæruleis.

HAB.—Khassya hills: on precipices at Moosmai and Mamloo, alt. 4000 ft.; not observed in flower or fruit.

DESCR.*—A palm of moderate height, (the specimen measures 9-10 feet,) the *trunk* 5 inches in diameter in the thickest parts, obscurely annulate. Under the *crown*, which is thick, is an oblong mass (2 feet long) of flattened bases of petioles, and their retia which are of stiff fibres.

Leaves about 3½ feet long: *petiole* 18 inches long, with irregular denticulate margins: *lamina* flabelliform reniform, (so is the entire part of the leaf) 2 feet long by 3½ feet wide: divisions about 65, the lateral ones shortest, 12-14 inches long, but the deepest divided, (viz. to within 5-6 inches of the apex of petiole) linear, their segments 1½-2 inches long, narrow, acute; central ensiform reaching to within 10-12 inches of the apex of the petiole, about 16 inches long, shortly and obtusely bilobed, segments about ½ inch long with recurved points; intermediate divisions also ensiform, about 18 inches long, their segments narrower and deeper than those of the central. Young leaves covered with thick, white, paleaceous tomentum.

* Entire? specimen of a trunk and crown, and two fruit-bearing spadices: these have been unnoticed since the return of the Assam Deputation in 1836. Seeds since received have germinated.

Spadix (fruit-bearing,) 2 feet long, nodding, compressed: the lower half concealed by the *spathes* of which there are three, two common ones, and one to one of the main branches. They are coriaceous, brown, with oblique mouths, and bilobed limbs, the lowest is about a foot long. *Branches* of the spadix quite exserted, quite naked; the terminal one dichotomous: divisions many. *Spikes* 4-6 inches long.

Fruit scarcely baccate, ½ inch long, 2½ lines broad, solitary or 2-3 together, but of distinct carpels, oblong, inæquilateral, obliquely apiculate at the apex, surrounded at the base by the calyx which has a stout cylindrical base, and three deep, broad oblong divisions, by a corolla of three cordate ovate petals, equal in length to the calyx, and by six sterile stamina: on one side may be found two abortive villous ovaries. *Seed* oblong, with the ventral face rather deeply furrowed, the furrow not reaching quite to the apex, reniform on a transverse section. *Albumen* with a scaly surface, along this line presenting a cavity filled with spongy tissue: horny, otherwise equal. *Embryo* in the centre of the dorsal face.

This species is closely allied to C. Martiana: it differs in its shorter stouter stature, the petioles toothed throughout, in the nature of the rete, and the texture of the leaves which is more like that of C. humilis. The paleaceous tomentum much more developed, and the berries are blueish, not yellow. The divisions of the leaves are much the same, excepting the secondary segments of the central divisions, which are shallow, obtuse and recurved.*

* Chamærops *Ritchiana*, (n. sp.) nana, sæpius subacaulis, petiolis inermibus, fibrillitio subnullo, lamina profunde palmatim 10-15 partita, laciniis induplicatissimis ultra medium bipartitis, segmentis rigidis angustis gradatim acuminatis.

Hab.—Khybur Pass, and generally in the low arid mountainous parts of Eastern Affghanisthan. Pushtoo name *Maizurrye*. Not observed in flower or fruit.

Descr.*—A small Palm, scarcely exceeding 2-3 feet in height, generally tufted, and generally almost stemless. There is scarcely any *rete*, but the bases of the petioles, where naturally covering each other, present a rust-coloured wool. *Leaves* from 20 inches to 3 feet in length, whitish-glaucous, coriaceous. *Petiole*

* From specimens brought from Affghanisthan, and a few seeds received from the Seharunpore Garden, of which one germinated in the H. C. Botanic Gardens.

Sect. II.

Folia pinnata. *Spatha* una completa. *Flores* dioici. *Corolla* fl. fæminei convoluto-imbricata. *Stamina* 6-9, raro 3, hypogyna. *Pistilla* 3, discreta. *Bacca. Semen* longitudinaliter exaratum.

Palmæ *perennantes, nanae et subacaules, frutescentes vel arboreae, saepius gregariae et locos aridos amantes.* Truncus *petiolorum cicatricibus vel basibus asper, rarius annulatus.* Petioli *inferne planiusculi depressi, superne compressissimi.* Rete *panniforme, copiosum.* Pinnæ *saepius fasciculatae, plurifariae, rigidae, glaucescentes, conduplicatae vel conduplicato-canaliculatae, venis diaphanis parallelo-striatae, rarius solitariae, bifariae, flaccidae, planiusculae; infimae in spinis degenerantes.* Inflorescentia *axillaris.* Spatha *completa, coriacea, bicarinata, primum antice aperiens, demum dextrorsum et sinistrorsum bivalvis, postremum decidua.* Spadix *saepius exsertus, racemi in modum ramosus, pedunculo compresso.* Spicæ

6-12 inches long, quite unarmed. *Lamina* palmate, laciniae (the fibres stout, often persistent,) 10-15 induplicate, divided to the middle or a good deal below into gradually acuminated rigid subsequently obtuse segments. The *seeds* seem to vary a good deal, some being oblong, others round, some again as large as a small marble, others not much bigger than a large pea, surface minutely wrinkled. *Raphe* tolerably distinct. *Chalaza* palmately branched. *Albumen* horny, very dense, with a good sized central cavity. *Embryo* near the base, narrow at the radicular end.

I have named it in honour of my friend Dr. Ritchie of the Bombay Medical Service, to whom I was indebted while in Affghanisthan for constant contributions of plants, and two valuable collections, one made between Candahar and Herat, and Herat and Bamean via Maimunna and Toorkistan, and another made about Pesh-Bolak and in the Khybur Pass. It is the only palm I met with in that country, and is of extensive use for making cordage, etc.; it may therefore appropriately commemorate an officer who was employed in Affghanisthan for a considerable time, and who was more extensively acquainted with that country than any other officer, excepting perhaps Major Pottinger.

It appears to be distinguished from C. humilis by its unarmed petioles, the want of a rete and the deeply divided laciniae of the leaves, which in C. humilis are quite entire,* or at the most bifid.†

* Desf. Fl. Atl. 2. p. 437. Syst. Veg. ed. Schult. 2. p. 1489.

† Mart. Palm. p. 248.

fasciculatae, subfastigiatae, saepius simplices. Flores *masculi, angulati.* Calyx *urceolatus, tridentatus.* Corolla *tripetala.* Stamina *hypogyna, saepius* 6. Antheræ *adnatae.* Pistillum *rudimentarium (an semper.?).* Flores *faeminei convoluto-clausi.* Calyx *maris.* Petala 3, *rotundata, carnoso-coriacea, convoluta.* Stamina *sterilia* 6. Ovaria *distincta.* Styli *distincti, recurvi.* Stigmata *subsimplicia.* Bacca *saepius oblonga, rubra vel demum nigrescens.* Albumen *aliquando ruminatum.* Embryo *centralis vel prope basin.*

Incolæ Africæ occidentalis et borealis, et præsertim Asiae tropicæ orientalis. Limes borealis specierum indicarum 30° grad; australis 5° grad.

Praebent farinam (*Sago* speciem), succum vinosum (*Taree*) et prae alia Saccharum. Fructus (Phaenicis dactyliferæ) edules, Arabis et Persicis aestimatissimi. Folia unius tegetibus apta, et petioli corbulis.

PHÆNIX.

(*Char. Sectionis.*)

Linn. Gen. ed. 6ta. p. 573. *No.* 1224. *ed. Schreb. p.* 776. *No.* 1194. *ed. Spreng. p.* 283. *No.* 1467. *Juss. Gen. p.* 38. *Gaertn. Sem. fruct.* 1. *p.* 23. *t.* 9. *Lam. Enc. Meth. t.* 893. (part. e Gaertn.) *Roxb. Icones* 15. *t.* 31, 32, 33. *Suppt.* 5. *t.* 15. *Fl. Ind.* 3. *p.* 783. *Endl. Gen. p.* 253. *No.* 1763. *Mart. Progr. p.* 11. *Palm. p.* 257. *t.* 120, 124. 136, 164. (ex Endl.)

Elate. (*Linn. Mus. Cliff. p.* 12. auct. Mart.) *Ait. Hort. Kew. ed. 2da.* 3. *p.* 280. *Lam. Enc. Meth. t.* 899. (e Rheedio.) *Linn. Gen. Pl. ed. Schreb. p.* 777. *No.* 1697. *ed. Spreng. p.* 250. *No.* 1304. *Sp. Pl. Willd.* 4. *p.* 170. *No.* 1682.

Katu Indel. *Rheede Hort. Mal.* 3. *p.* 15. *t.* 22-25.

65. (1.) P. *acaulis*, **trunco brevissimo bulbiformi, foliis fasciculatis linearibus conduplicatis sub-quadrifariis, spadicibus faemineis terra semi-immersis et in spathis e maxima parte inclusis, fructibus oblongis, embryone in centrum dorsi.**

P. acaulis. *Roxb. Hort. Bengh. p. 73. Fl. Ind. 3. p. 783.** *Icones Suppt. 5. t. 15. Buch. Hamilt. Comment. in Hort. Malab. in Linn. Trans. 15. p. 88. Sprengel Syst. Pl. 2. p. 139.*

Hab.—Behar, (*Roxb.*) Elevated plains on the north side of the Ganges on a clayey soil. *Buchanan Hamilton.* Chota Nagpore. *Col. Ouseley.* Plains between the valley of Hookhoong and Mogam. *Junglee Khujur.*

Descr.—"*Stem* none in plants 10 years old; at this age when in flower, the whole body of the plant, including the inflorescence, but exclusively of the foliage, is of an ovate form, and not exceeding six or eight inches in height from the surface of the ground. *Leaves* (*Fronds*, L.) pinnate; from two to six feet long. *Leaflets* in nearly opposite, rather remote fascicles; the superior ones folded, slender, ensiform, and about eighteen inches long; lower ones small, straight, rigid, and ending in very sharp, spinous points. *Petioles* (*stipes*) near the base flat, towards the apex triangular, smooth. Male. *Spathes* and *spadix* as in the female hereafter described. *Flowers* alternate, solitary, sessile, small, pale yellow. *Calyx* one-leaved, triangular; *angles* or *lobes* acute, unequal. *Corol* three petalled; *petals* obliquely-lanceolate, acute, slightly united at the base. *Filaments* six, very short, inserted into the base of the corol. *Anthers* linear, nearly as long as the petals. *Pistil* none. Female. *Spathes* universal, axillary, solitary, one-valved, about six inches long, with their base rather below the surface of the earth, generally splitting into two portions down the middle on each side. *Spadix* ramous, composed of many, simple, short, erect, flexuose branches; all are smooth, and of a pale yellow. *Flowers* alternate, solitary, sessile, in bractiform notches on the sides of the branches of the spadix. *Calyx* cup-shaped, truncate, with three obscure points at equal distances on the margin. *Petals* three, sub-rotund, thick and fleshy, concave, smooth. *Nectary* a small, six-toothed cup in

* Buchanan is here given as the authority, but this appears to be a mistake, see Linn. Trans, xv. p. 85.

which the germs sit. *Germs* three, each one-celled, and containing a single ovulum attached to the middle of the cell on the inside. *Styles* three, recurved, small and short. *Stigma* small. *Drupe* oval, fleshy, small, smooth, of a bright red, of the size of a very small olive, one-celled. *Seed* solitary, oblong, with a deep longitudinal groove on one side. *Embryo* in the middle of the back, or convex side of the seed." *Roxb. o. c. l. c.*

This species varies considerably in the size of the leaves and breadth of the pinnæ, and in the size and degree of exsertion of the male spadix. The male plant is probably scarcely distinguishable from that of the succeeding, but the female is at once by the shortness of the peduncle of the spadix, which is generally shorter, and never, so far as I know, longer than the spathes.

Dr. Royle* mentions a species closely allied to, if not identical with this, inhabiting the Kheree Pass, Siwalik Hills, at an elevation of 2500 feet, in company with Pinus longifolia. I omit his name, because it is not accompanied with any defining characters. Most probably it is the succeeding or a third species of this form, which requires much more examination than it has received.

I subjoin the description of a specimen sent by Colonel Ouseley, who informs me that it is considered by the natives as a distinct species. The only differences I can detect are the shortness and less induplication of the pinnæ, and the colour of the fruit.

P. *acaulis var. melanocarpa.*

Descr.—A dwarf palm not exceeding 2 feet in height, including the leaves. *Stem* bulbiform, 6 inches long, covered with the protuberant hardened persistent bases of the petioles, their points being spreading recurved. *Leaves* 1-1½ foot long, ascending then spreading. *Petiole* below flat, above quite compressed. *Pinnæ* subfasciculate, fascicles subopposite, some ascending on either side others spreading,

* Illustr. p, 394, 397.

attached by broad cartilaginous insertions above which they are conduplicate, glaucescent, spinous pointed, the upper ones the largest, 7-8 inches long, ½ inch broad, conduplicate near the base above this almost flat (at least the old ones): the lowermost are degenerated into strongish channelled 3-gonal spines, the rest present intermediate characters.

Spadices of both sexes buried among the persistent bases of the petioles, of the fruit only partly exserted, without spathes; *spikes* 2-3 inches long, stout. *Fruit* suffulted by a green angular bracte, sessile, alternate, of the size of a small olive, at first reddish, afterwards black-purple: apex distinctly cuspidate, base surrounded by an angular tridentate calyx, by the imbricated broad petals and by 6 small abortive stamina. *Endocarp ?* (tegument ?) thin, like silver paper. *Seed* one, erect, greyish, deeply furrowed on one side and with about 7 striæ on the remaining part of the surface. Along the same furrow the horny *albumen* is deeply grooved, the groove filled with spongy substance. *Embryo* at or a little below the centre of the dorsal face.

66. (2) P. *Ouseleyana*, (n. sp.) trunco brevissimo bulbiformi, foliis fasciculatis linearibus conduplicatissimis angustissimis, spadicibus fœmineis longe exsertis spathis multoties longioribus.

Hab.—Chota Nagpore, *Col. Ouseley.* Assam, *Major Jenkins.*

Descr.*—Bulbous *stems* ovate, imbricated conspicuously with the hardened scale-like bases of the petioles, about a foot in length and 6 inches in diameter. *Rete* of a few rigid fibres. *Leaves* 2½-3 feet long. *Pinnae* entirely conduplicate, about a foot long, from the conduplication 2-2½ lines broad, subulate-acuminate; lowermost degenerated into short spines. *Male spadices* about a foot long, the ends of the uppermost *spikes* rather longer than the bivalved carinate *spathe. Female spadices* 2-2½ feet long with a few

* Specimens. A male and female specimen entire, but without flowers or perfect female spathes, communicated by Major Jenkins.

short flexuose spikes towards the apex, much longer than the spathes, which appear to be about a span long. *Peduncles* of both spadices much flattened.

Colonel Ouseley, Agent to the Governor General S. W. Frontier, first directed my attention to the distinguishing marks of this species, which I have therefore dedicated to him, and also as a tribute of respect for his exertions in bringing to notice the vegetable products of the districts under his charge, as well as the valuable grains of Central India.

67. (3) P. *farinifera,* trunco brevissimo, pinnis oppositis, spadicibus exsertis, fructibus oblongo-ovatis, embryone ad medium faciei dorsalis.*

P. farinifera, *Willd. Roxb. Cor. Pl.* 1. *p.* 55. *t.* 74. *Icones.* 15. *t.* 32. (inflor) *Fl. ind.* 3. *p.* 785. *Sprengel Syst. Pl.* 2. *p.* 139. P. pusilla. *Lour. Fl. Coch. ed. Willd. p.* 753. *Gaert. Sem. et. Fruct.* 1. *t.* 9. ?†

Hab.—Dry barren parts chiefly of the sandy lands at a small distance from the sea near Coringa. Flowers in Jan. Feb; fruit ripens in May. Telinga name *Chilta-cita. (Roxb.)* Common on all the hilly country between the Ganges and Cape Comorin *(Buchanan Hamilton.)*

Descr.—" *Trunk,* the little it has is only about one or at most two feet high, and so entirely enveloped in the sheaths of the leaves that it is never seen, the whole appearing like a large round bush. *Leaves* pinnate. *Leaflets* opposite, sword-shaped, much pointed, smooth, of a deep green. *Spathes* axillary, one-valved, concave on the inside, fitting the trunk or base of the leaf immediately with it; this concavity is bordered by two sharp edges; convex on the outside, there splitting longitudinally, leathery, smooth, withering.

* Char. e Roxb.

† This synonym is I think doubtful, as Roxburgh's figure does not agree with figs. f. g. of Gærtner.

Spadix erect, very ramous, branches simple, spreading in every direction, from eight to twelve inches long. Male Flowers. *Calyx* small, slightly three-toothed. *Petals* three, oblong, white, rigid. *Filaments* six, very short, inserted into a fleshy globular receptacle. *Anthers* oblong, erect. Female Flowers on a separate plant. *Calyx* as above. *Petals* three, orbicular, concave, equal, rigid, lasting. *Germs* three, though never more than one ever increases in size, the other two always wither, although they contain the rudiment of a seed every way like the fertile germ; ovate, each ending in a short recurved style. *Stigma* simple. *Berry* when ripe, of a shining black, of the size of a large French bean; the *pulp* is sweet and mealy, but in small quantity, the natives eat them as gathered from the bush without any preparation. *Seed* cartilaginous, of the shape of the berry, grooved longitudinally, as in the common date, pretty smooth, brown on the outside, of a light greyish white within, on the middle of the back there is a small elevation, under which is an oblong pit containing the embryo or first principle of the new plant."

The leaflets are wrought into mats for sleeping upon, &c. The common petioles are split into three or four, and used to make common baskets of various kinds, but they are not so good for this purpose as the Bamboo, which is very elastic, much more durable, and splits easily. The small trunk when divested of its leaves, and the strong brown fibrous web that surrounds it at their insertions, is generally about fifteen or eighteen inches long, and six in diameter at the thickest part; its exterior or woody part consists of white fibres matted together, these envelope a large quantity of farinaceous substance, which the natives use for food in times of scarcity. To procure this meal, the small trunk is split into six or eight pieces, dried, and beat in wooden mortars till the farinaceous part is detached from the fibres; it is then sifted to separate them, the meal is then fit for use. The only further preparation it undergoes, is the boiling it into a thick gruel, or as it is called in India, *Kanji*; it seems to possess less nourishment than the common sago, and is less palatable, being considerably bitter when boiled; probably a little care in the preparation, and varying the mode, might improve it; however, it certainly deserves attention, for during the end of the last, and beginning of this year, and again at this present time,

May 1792, it has saved many lives. Rice was too dear, and at times not to be had, which forced many of the poor to have recourse to these sorts of food. Fortunately it is one of the most common plants on this part of the coast, particularly near the sea."— *Roxb o. c. l. c.*

There is a (male) specimen called P. farinifera in the Botanic Gardens. It has a *trunk* 4 feet high, 6-8 inches in diameter, rough with the persistent bases of the *petioles*. The *leaves* are 3-4 feet long, spreading; the *pinnæ* in subopposite fascicles, (the lower generally in pairs,) sub-4 farious, (upper series sub-ascending, lower very spreading, but obliquely) canaliculate, conduplicate at the base, glaucescent, subulato-acuminate, 10 inches long, 6 lines wide, those next the spinous ones, which occupy the lowest 8-10 inches of the petiole, longest and narrowest. The *spadix* is 1-1½ foot long, the peduncle well exserted from the axilla and compressed.

This can scarcely be Roxburgh's plant, since it has a distinct stem and fasciculate pinnæ. It seems exactly intermediate in foliage between P. acaulis and P. dactylifera of these Gardens.

68. (4.) P. *sylvestris*, arborea, pinnis densis fasciculatis rigidis lineari-ensiformibus conduplicato-canaliculatis acuminatissimis, fructibus cylindraceo-oblongis, embryone ad vel supra centrum faciei dorsalis.

P. sylvestris. *Roxb. Hort. Bengh. p.* 73. *Fl. Ind.* 3. *p.* 787. *Icones.* (fl. et. fr.) 15. *t.* 31. *Ham. Comm. Hort. Mal. Linn. Trans.* 15. *p.* 86. Katou-indel. *Rheede. Hort. Mal.* 3. *t.* 22-25.*

Hab.—Common all over India, all soils and situations seeming to suit equally well. Flowers at the beginning of the hot-season, (Roxb.)

* The fruit here figured is very much smaller, and of a different shape than it is in Bengal, at least on uninjured trees.

The most common Palm of India. *Buchanan Hamilton.* Beng. *Khujjoor* ; Sansc. *Khurjura* ; Teling. *Peddu eita.*

Descr.—A very handsome palm, often when uninjured by extracting toddy, 35-40 feet in height. *Trunk* rough from the persistent bases of the petioles. *Crown* about hemisphærical, very large and thick. *Leaves* 10-15 feet long. *Petiole* compressed only towards the apex ; at the base bearing a few channelled triangular short spines. *Pinnæ* very numerous, densely fascicled, glaucous, rigid, ensiform, 18 inches long, 1 inch 3 lines wide, conduplicate at the base, then canaliculate, subulato-acuminate, almost spinous pointed, 4 farious, some intermediately spreading, others crossing these above and below in an ascending direction. *Male spadix* 2-3 feet long : peduncle highly compressed. *Spathes* of about the same length, very coriaceous, almost woody, covered with brown scurf, separating into two boat-shaped valves. *Spikes*, exceedingly numerous towards the apex of the peduncle, and chiefly on its anterior face, generally in fascicles and simple, 4-6 inches long, slender. very flexuose. *Flowers* 3 lines long, very numerous, angular, oblique. *Calyx* cup-shaped, with three short rounded teeth. *Petals* 3-4 times longer than the calyx, concave, warty on the outside, on the inside deeply ridged and furrowed. *Filaments* (free,) scarcely any. *Anthers* linear, adnate, a little shorter than the petals.

Female spadix much the same, as are the spathes. *Spikes* inserted in distinct groups, 1-1½ foot long, not bearing flowers throughout the lower 4-6 inches, flexuose. *Flowers* distant, roundish. *Calyx* cup-shaped, obsoletely three-toothed. *Petals* 3, very broad, much convolute-imbricate, leaving a small opening at the apex. *Barren stamina* 3-4. *Ovaria*, three ; *ovules* solitary. *Style* recurved, inwardly papillose.

Spadix of the fruit 3-feet long, nodding at the apex from the weight of the fruit, very compressed, of a golden orange colour. *Fruit* scattered on long pendulous nodding similarly coloured spikes, with brown orange swollen bases, oblong, very obtuse, 14 inches long, 7-8 lines wide, with an oblique mark of the base of the style, surrounded at the base by the perianth. *Pulp* yellow, moderate, very astringent, lined by irregular cellular white tissue, part of this ad-

heres to the thin envelope that separates with the seed. *Seed* oblong, deeply grooved (margins of the groove slightly wrinkled) along its whole length on one side, on the other with a slight incomplete furrow, in the centre of which is a depression with a mammillate fundus, the situation of the embryo. *Albumen* on a transverse section horse-shoe-shaped. *Embryo* at or a little above the middle of the dorsal face.

My materials do not enable me to point out any distinction between this and P. dactylifera,* the true Date Palm. In appearance they would seem to be indistinguishable. Roxburgh says nothing in the Flora Indica regarding this in explication of his specific character. But in a pencil note to the unfinished drawing of P. sylvestris, he says the male flowers of P. dactylifera are most exactly like. Buchanan Hamilton considers it the wild state of the true Date Palm, so much cultivated in Arabia and Africa, and states, that on comparing young plants, he had not been able to see the smallest difference, except that the Arabian plant was rather the largest and more vigorous.† Compared with Gærtner's figure of P. dactylifera, 1, t. 9. the fruit of P. sylvestris is considerably smaller. The embryo also is on the central line.

I have only seen Martius's character of P. dactylifera, (loc. cit.) at which species the Botanic Garden copy of his Palmæ breaks off.

* The plant called Phœnix dactylifera of these Gardens does not attain a greater height than 4-5 feet. *Trunk* remarkably stout, 1 foot or more in diameter, marked with the scars of the petioles. *Leaves* 7-8 feet long. *Petioles* compressed a long way down, in the lower 2 feet bearing many stout rigid channelled spines. *Pinnæ* fascicled, their direction as in P. sylvestris, but in a less marked degree, bifarious when young, 1 foot long, 1 inch broad, subulato-acuminate, those next the spines longest and narrowest.

Spadix 2-2½ feet long, branched at the apex; *peduncle* 1-1½ foot long, much compressed.

This plant is evidently closely allied to P. sylvestris, and with P. farinifera of the Gardens forms a complete transition from P. sylvestris to P. acaulis. Both it and this so-called P. farinifera require more examination.

† Comm. in Hort. Mal. op. cit. p. 82, 83, 85.

"This tree yields *Tari*, or Palm wine, during the cold seasons. The method of extracting it destroys the appearance and fertility of the tree. The fruit of those that have been cut for drawing off the juice being very small.

"The mode of extracting this juice is by removing the lower leaves and their sheaths, and cutting a notch into the pith of the tree near the top, from thence it issues and is conducted by a small channel made of a bit of the Palmyra tree leaf into a pot suspended to receive it. On the coast of Coromandel this Palm juice is either drunk fresh from the tree, or boiled down into sugar, or fermented for distillation, when it gives out a large portion of ardent spirit commonly called *Paria aruk* on the coast of Coromandel. Mats and baskets are made of the leaves.

"The Bengalees call this tree *Khujjoor*. They also boil the juice into sugar. In the whole Province of Bengal about fifteen thousand maunds, or about a hundred thousand hundred-weight, is made annually. At the age of from seven or ten years, when the trunk of the trees will be about four feet high, they begin to yield juice, and continue productive for twenty or twenty-five years. It is extracted during the cold months of November, December, January, and February; during which period, each tree is reckoned to yield from one hundred and twenty to two hundred and forty pints of juice, which averages one hundred and eighty pints; every twelve pints or pounds is boiled down to one of *Goor or Jaguri*, and four of *Goor* yield one of good powder sugar, so that the average produce of each tree is about seven or eight pounds of sugar annually.

"Another statement presented to me, gives a much larger produce, viz. the average produce of each tree is sixteen pints per day, four of which will yield two pounds of molasses, and forty of molasses will yield twenty-five pounds of brown sugar. The difference is so great, that I cannot well reconcile them, but am inclined to give most credit to the first.

"Date sugar, as it is here called, is not so much esteemed as cane sugar, and sells for about one fourth less." *Roxb. o. c. l. c.*

69. (5.) P. *paludosa*, arbuscula, trunco basi annulato, pinnis solitariis bifariis ensiformibus acuminatissimis patenti-

nutantibus, spathis antice aperientibus, spadicibus exsertis, fructibus ovatis, embryone hilum versus.

P. paludosa, *Roxb. Hort. Bengh. p.* 73. *Fl. Ind.* 3. *p.* 789. *Icones.* 15. *t.* 33, (indifferent.)

Hab.—The Sunderbuns, where it forms a considerable portion of those impenetrable woods which completely cover that extensive tract of country, (*Roxburgh.*) Along the Salueen, between Amherst and Moalmain. Penang, (*Mr. Lewes,*) where it is known by the name *Dangsa.* Sansc. name *Hintala;* Bengal. *Hintal.*

Descr—The specimens in the Botanic Gardens form very elegant impenetrable tufts. *Trunk* 12-15 feet high, 3½ inches in diameter, annulate at the base, otherwise covered with the brown, retiferous, armed petioles. *Leaves* gracefully spreading, 8-10 feet long. *Petiole* covered with scurf, brownish-glaucescent, in the lower 3 feet bearing irregularly spreading, hard, brown, triangular, channelled, rather long spines. *Pinnæ* bifarious, solitary, spreading, then curved downwards, not rigid, 2 feet long, 8 lines wide, exceedingly acuminate, bifarious, conduplicate at the base, otherwise flat, underneath glaucous-cæsious, the lowest longest and narrowest. *Spadix* (*male*) about a foot long. *Spathes* coriaceous, bicarinate, opening anticously, orange brownish; keels with irregular edges, that of the spadix about equalling it: of the female half as short. *Flowers* yellow, more distant than in the other species. *Calyx* cup-shaped, less regularly three toothed than in P. sylvestris or farinifera. *Petals* three. *Filaments* six, short.

Spadix (female) about 1½ foot long, flowers greenish. *Calyx* as in the male. *Petals* roundish, concave. Sterile *stamina* 6. *Ovaria* three, styles recurved, longer than in the other species.

Spadix of the fruit 3-4 feet long, erect, yellowish orange, branched at the apex. *Spikes* of the same colour, generally several together, with cartilaginous thickened bases, about a foot long, nodding, rarely branched. *Fruit* sessile, on thickened knobs, spreading or pointing downwards, first yellowish, then red, lastly black-purple, oval, 6-7 lines long, 3-4 wide, with a small oblique apiculus at

apex, at the base the more or less split perianth. *Seed* ovate, compressed, with a rather deep furrow on one side, ceasing just above the middle, and with an indistinct furrow on the opposite side. Groove of the *albumen* deeper at either end than in the middle. *Embryo* near the base.

This species is not likely to be confounded with any other. Its habit is less genuine than in the others. It is at once distinguished by the bifarious flaccid flat solitary pinnæ, the shape of its fruit and the situation of the embryo.

" The trunks of the smaller trees serve for walking sticks, and the natives have an idea that snakes get out of the way of any person having such a staff. The longer ones serve for rafters to their houses, and the leaves for thatch." *Roxb.*

It is well worth cultivation on account of its elegance, and its being adapted for bank scenery.

So far as I know, it is the most southerly species of the genus, at least of the Northern hemisphere.*

(To be continued.)

On some Plants in the H. C. Botanic Gardens. By W. GRIFFITH, *Esq., Corr. Memb. Royal Acad. Soc. Turin. etc. etc. Asst. Surgeon, Madras Establishment.*

GEODORUM.

Jackson in Andr. Bot. Rep. 10. *t.* 626. *R. Brown in Hort. Kew. ed.* 2. 5. *p.* 207. *Endl. Gen. Pl. p.* 200. *No.* 1433. Cistella. *Blume. Tabellen.* 55. Limodorum. *Roxb. Cor. Pl. t.* 39-40.

* I have very lately received the leaves and fruit spadices of a fifth species from Dr. Wight, who informs me that he communicated imperfect specimens of the same to Dr. Martius many years ago with the MSS. name P. pedunculata. It appears to be at once recognizable by the great length of the peduncles of the fruit spadices, which are 3½-4 feet long. An account will appear in the Supplement.

CHAR. GEN.—*Sepala* et *petala* subconformia, subsecunda. *Labellum* cucullato-ventricosum, sessile, cum columna continuum, basi sub-calcaratum. *Anthera* bilabiata. *Pollinia* 2. postice foveolata.

HABITUS.—Herbae *terrestres tuberosae.* Folia *plicata.* Scapi *apice recurvato-penduli.* Flores *saepissime spicati, congesti, postici.*

G. *laxiflorum,* (n. sp.) scapo foliis breviore, spica pendula laxiflora, sepalis oblongis, petalis oblongo-ovatis duplo latioribus, labello subcalcarato rotundato cochleariformi a medio supra dilatato undulato emarginato.

HAB.—Assam, *Major Jenkins.* Flowers here in May.

DESCR.—Old *stems* or tubers short, obturbinate, marked with the scars of fallen leaves. *Leaf stem* about a foot high, including the *leaves* which are 3-5, the more perfect 8-10 inches long, ovate-lanceolate, conduplicate, sub-acuminate, undulate. *Scape* twice as short, with a few membranous, whitish sheaths. *Bractes* narrow-lanceolate, shorter than the ovarium. *Flowers* 8-10, whitish, rather large. *Perianth* spreading. *Sepals* linear-oblong, obtuse, the lateral rather broader, with oblique emarginate points. *Petals* oblong-lanceolate, twice as broad. *Labellum* sub-calcarate at the base, roundish, cochleariform, entire, upper-half undulate, sub-deflexed, emarginate: colour white, floor tinged with yellow, at the base where it is joined with the labellum is a patch of purplish, short cellular hairs *Column* stout, short, with similar but more minute hairs at the base: lateral teeth of the apex distinct. *Anthers* whitish, lower lip chiefly purple. *Clinandrium* shallow, prolonged or acuminate behind, its floor keeled, with a conical shining tooth towards the stigma, with which it is apparently continuous. *Pollen-masses* oblong, excavate behind. *Caudicula* broadly spathulate, cucullate towards the pollen-masses. *Gland* roundish.

This species is nearly allied to G. dilatatum, (Limodorum recurvum, Roxb.) but differs from it in the thinly flowered

spike, the broad petals, and the round cochleariform entire labellum, which when spread out is of a cordate shape.

G. *appendiculatum*, (n. sp.) scapo foliis breviore, spica pendula, floribus congestis, sepalis lineari-vel spathulato-oblongis, petalis oblongo-ovatis latioribus, labello subcalcarato apice late obreniformi fundo (partis centralis) cristato, columna basi elongata in pedem subæquantem.

G. dilatatum, *Lindl. Bot. Reg.* 8. *t.* 6 ?

Hab.—Assam. Flowers here in May.

Descr.—A foot or rather more in height. *Leaves* about four, oblong-ovate, shortly acuminate. *Scape* a span in height. *Spike* pendulous. *Bracts* linear-lanceolate, acuminate, longer than the ovaria. *Flowers* crowded, white. *Sepals* linear-oblong, nearly equal. *Petals* ovato-lanceolate, rather broader. *Labellum* subcalcarate, keeled below along the middle, with a reniform emarginate crenato-repand apex, when flattened out almost three-lobed. The floor, along the upper half presents a flat slight elevated *crest*, terminating in a toothed or denticulate manner at the base of the reniform part. *Column* produced at the base into a foot nearly as long as itself, white; lateral *teeth* of the apex obsolete. *Pollen masses* oblong, roundish. *Caudicula* short, narrower than usual. *Gland* roundish, comparatively small.

This species is nearly allied to G. pallidum, but is distinguished by the shape of the crested labellum and the prolonged base of the column.

A drawing of it exists here, among those executed during Dr. Wallich's superintendence, named Geodorum pallidum, *Don*, an erroneous name, if Dr. Lindley's synonymy of G. pallidum be correct. A variety exists with flesh-coloured flowers, and the labellum variegated with purple, this I apprehend is the G. dilatatum, Bot. Reg. loc. cit.

G. *pallidum*, scapo foliis breviore, spica pendula, floribus congestis, sepalis, lineari-oblongis subæqualibus, petalis ob-

longo-lanceolatis duplo latioribus, labello sub-calcarato sub-trilobo lateribus basin versus erectis columnam fere obtegentibus apice dilatato fundo processigero.

G. pallidum, *Don. Prodr. Fl. Nepal. p.* 31.? *Lindl. Gen. et Sp. Orch. p.* 176. Limodorum candidum. *Roxb. Icones. Suppt.* 5. *t.* 103. *Fl. Ind.* 3. *p.* 470. Béla-pôla. *Rheede. Hort. Mal.* 12. *t.* 35.?

HAB.—Sylhet. Moulmein. Flowers here in April and May.

DESCR.—*Spike* pendulous, conical. *Flowers* rather small, crowded. *Sepals* linear oblong, the lateral ones rather broader. *Petals* oblong-lanceolate, twice as broad. *Labellum* keeled below, sub-calcarate, almost three-lobed, the side towards the base erect and almost concealing the column, dilated about the middle, apex emarginate, subtruncate with revolute margins, the floor with indistinct irregular cellular longitudinal processes. *Column* short, sprinkled in front with purple dots ; lateral *teeth* of the apex obsolete or small, bluntly conical.

This appears to me to be Roxburgh's Limodorum candidum ; as it agrees tolerably well with the figure quoted above. It appears to me sufficiently distinct from Roxburgh's drawing of Limodorum recurvum, (G. dilatatum,) to which Dr. Lindley seems inclined to refer it, by the small flowers, narrow sepals, and the shape and disposition of the labellum.

G. *attenuatum* (n. sp.) scapo foliis breviore, spica nutante pendula, floribus congestis ascendentibus vel erectis, sepalis petalisque subæqualibus oblongis, labello ecalcarato calceolatiformi e basi dilatata bicristata attenuata, columna nanissima.

HAB.—Burmah. Flowers here in May.

DESCR.—About 10 inches or a foot in height. *Leaves* about 3, ovate or oblong-ovate, acute, 4-6 inches long. *Scape* about twice as

short. *Spike* truncate. *Bractes* whitish, linear, about as long as the ovaria. *Flowers* white, inodorous, ascending or erect. *Perianth* less spreading than usual. *Sepals* oblong, mucronulate, the lateral rather broader. *Petals* more oblong, rather broader. *Labellum* ecalcarate, keeled along the middle underneath, very concave and broad below the middle, above attenuate into a concave, almost conduplicate, emarginate, crenated apex. It has two short converging *crests* at the base, which leave a small cavity between them. Colour white, crests and attenuated apex yellow. *Column* very short, stout, sprinkled with purple cellular pubescence below the stigma and along the broad line of union of the lip. A bidentate tooth on either side of the apex. *Anthers* white, with dark purple sides and under-lip. *Pollen masses* oblong. *Caudicula* broad, short. *Gland* very broad and large.

This species is at once recognised by the as it were truncate spike, the ascending flowers, less spreading perianth, shape of the labellum and extremely short column.

A drawing of it exists, marked in pencil G. candidum, Wallich, without any description or explanation, or information. This same name will be found in No 7374 of this Botanist's Catalogue, and is referred to G. pallidum, (Don.) in Lindl. genera and species. The Limodorum candidum of Roxburgh, as has been seen, is a very different plant. It is one among many instances that a Botanist, who attaches MSS. names profusely and without examination, who thinks Herbaria useless to Indian Botanists, and who does not even keep his series of drawings complete, can never be sure of recognising one of his own species. And if in a small genus of 6-8 species one or two instances of such confusion arise, what may not be expected in extensive genera; what cumbersome and useless additions to synonymy, if any, the least, attention be paid to such names.

The remaining Indian species of this genus are as follows:—

G. *purpureum*, scapo foliis longiore, racemo pendulo, floribus alternis, labello ovato acuto picto.

G. purpureum. *R. Br. in Hort. Kew. ed. 2da. 5. p.* 207. *Lindl. Gen. sp. Orch. p.* 175. Limodorum nutans. *Roxb. Corom. Pl.* 1. *t.* 40. *Icones* 13. *t.* 63. *Fl. Ind.* 3. *p.* 470. Malaxis nutans. *Willd.* 4. *p.* 93.

HAB.—Moist valleys among the Circar hills. (*Roxb.*)

Roxburgh's drawing represents a spike not a raceme: it is the only Indian species yet known in which the scape exceeds the leaves in length.

G. *citrinum*, scapo foliis breviore, spica pendula, floribus congestis, sepalis petalisque æqualibus acuminatis, labello subcalcarato apice obtuso integerrimo.

G. citrinum. *Andr. Bot. Rep.* 10. *t.* 626. *R. Br. in Hort. Kew. ed.* 2-5. *p.* 207. *Lindl. Gen. sp. Orch. p.* 176.

HAB.—Pulo Pinang. Chittagong.

Flowers large, straw-coloured. *Labellum* yellow at the apex and marked on either side with a faint purple intromarginal line.

G. *dilatatum*, scapo foliis breviore, spica pendula, floribus congestis, sepalis petalisque (latioribus) oblongo-lanceolatis, labello subcalcarato apice dilatato crenulato.

G. dilatatum. *R. Br. in Hort. Kew. ed.* 2-5. *p.* 207. *Lindl. Gen. sp. Orch. p.* 175. Cistella cernua. *Blum. Bijd. p.* 293. *Tabellen. t.* 55. Limodorum recurvum. *Roxb. Corom.* 1. *t.* 39. *Icones* 13. *t.* 62. *Fl. Ind.* 3. *p.* 469. Malaxis cernua. *Swz. Willd.* 4. *p.* 124.

HAB.—Valleys among the Circar Hills.

Roxburgh's figure of this species, (Cor. Pl. loc. cit,) which is copied from his original drawing referred to above, repre-

sents the flowers as larger, the labellum shovel-shaped or panduriform, yellowish in the lower half, longitudinally veined with purple in the dilated apex.

The following may be proposed as a temporary arrangement of the species.

1. G. purpureum.
2. — attenuatum.
3. — pallidum.
4. — dilatatum.
5. — appendiculatum.
6. — laxiflorum.
7. — citrinum.

EXPLANATION OF PLATE XXIV.

Geodorum laxiflorum.

1. End of a spike.
2. Flower, in front.
3. Labellum, ditto.
4. Labellum and column.
5. Anther, under face.
6. Pollen masses, front and back views.
7. Column and stamen in front.

Geodorum appendiculatum, (upper figures.)

1. Apex of a spike.
2. Flower in front.
3. Labellum and column.
4. Anther, under face.
5. Pollen masses, etc., back view.
6. Column viewed obliquely, anther removed.

Geodorum attenuatum, (under figures.)

1. Apex of a spike.
2. Flower, side view.
3. Labellum, obliquely.
4. Anther, under face.
5. Pollen masses, front.
6. Column, in front, anther removed. All but figures 1. of each series representing the spikes, more or less magnified.

APPENDICULA.

Blume. Bijdr. p. 207. *Tabellen.* 40. *Lindl. Gen. et Sp. Orch. p.* 227. *Endl. Gen. Pl. p.* 205. *No.* 1483.

CHAR. GEN.—*Perianthium* connivens. *Sepalum* tertium subfornicatum, lateralia cum pede columnæ adnata calcar obtusum saccumve mentientia. *Labellum* cum pede columnæ continuum, inclusum, indivisum, vel subtrilobum, appendicutum. *Columna* nana. *Anthera* dorsalis. *Pollinia* 8, vel abortu pauciora, in glandulam sessilia.

HABITUS.—*Epiphyticae.* Caules *simplices vel ramosi.* Folia *disticha; lamina dextrorsum sinistrorsum versa.* Vaginae *in paucis utrinque processu stipuliformi auctae.* Racemi *oppositifolii, vel* Glomeruli *paleacei terminales.* Flores *minuti.*

A. *callosa,* caulibus caespitosis simplicibus, foliis oblongo-parallelogrammicis basi deltoideo-cordatis apice bidentatis (sinu mucronato), glomerulis florum terminalibus paleaceis, petalis lineari-acuminatis, labelli sub-trilobi lobis lateralibus dentformibus centrali cordato-ovato basi calloso apice rotundato, columna apice biauriculata.

A. callosa, *Blume. Bijdr. p.* 303. *Lindl. Gen. et spec. Orch. p.* 230.

HAB.—Penang. *Mr. Lewes.* Flowered here in October, succeeding well in broken potsherds.

DESCR.—*Stems* 6-10 inches long, tufted, erect or spreading, covered with the sheaths of the leaves, which have black scarious margins, and are prolonged at the apex on either side into a linear-setaceous black process, *(stipula.) Lamina* of the *leaves* exactly bifarious, perpendicular, (looking right and left,) oblong, parallelogrammic, deltoideo-cordate at the base, at the apex bidentate with the sinus mucronate: they are 2½ lines long, 1¼ broad, coriaceous, one-veined, parallel striate. *Head of flowers* terminal, oblique or sub-erect, paleaceous, sometimes proliferous. *Flowers* generally ex-

panding, one at a time, almost immersed in the paleae, minute, half-resupinate, whitish. *Perianth* ringent. *Sepals* acute, the anticous one ovate, concave, the lateral very oblique at the base and forming with the foot of the column and base of labellum a large roundish sac. *Petals* the length of the sepals, linear-acuminate. *Labellum* included, continuous at the base with the foot of the column with which and the lateral sepals it forms the sac, 3-lobed; the lateral lobes, (up to which it is parallel with the column,) tooth-shaped, erect, the central ovate-cordate, conduplicate, with minutely undulate margins; its base occupied by a sulcate subtrilobed callus. *Column* short, roundish, obliquely ascending, almost deficient behind, obtusely auriculate on either side at the apex, the auricles concave and sanguineous inside. *Rostellum* linear-linguiform, almost vertical, projecting beyond the auricles; *stigma* vertical. *Anthers* dorsal, fleshy, almost immersed, bilocular, cells 4-locellar. *Pollen masses* 8, clavato-pyriform, sessile on an oblong brownish gland. *Ovarium* 6-costate.

As it agrees tolerably with Blume's character, I have referred it to his A. callosa. But it is to be regretted that such short insufficient characters should be resorted to, when such variation in form runs through so many organs. Characters should always be as prospective as possible, and with this view should express the peculiarities of each of the organs from which they can be drawn.

The presence of the divisions on the margin of the sheaths near the base of the lamina is remarkable. They are probably analogous to such stipulae as those of Rosa, which are nothing but the lowermost undeveloped lobes of the leaf. Such stipulae have not, so far as I know, been hitherto observed in Monocotyledons, although the possibility of their existence is indicated by some species of Smilax and Dioscorea.

The section of Appendicula to which Blume refers this, is closely allied to Agrostophyllum, (and perhaps to Glomera,) from the former of which it differs only in habit, which is very peculiar, and the structure of the column.

EXPLANATION OF PLATE XXVI.

(left hand.)

Appendicula callosa.

Portion of a flowering stem, (natural size.)

1. Flower, or rather spike, laterally.
2. End of labellum, inner surface, in front.
3. Flowers, laterally, sepals removed.
4. Labellum and column, laterally.
5. Column, anther reflexed, laterally.
6. Anther, under face.

9. Column, front view, } foot removed.
8. Ditto, back, }

7. Pollen masses.

All but the figure of the flowering stem more or less magnified.

XIPHOSIUM.

CHAR. GEN.—*Perianthium* posticum, ringens, glabrum. *Sepala* carinata, lateralia cum pede columnae in gibberem connata. *Labellum* cum pede columnae articulatum, tremulum, trilobum. *Columna* pede elongato. *Anthera* terminalis. *Pollinia* 8, ope materie pulverea viscosa copiosa cohærentia. *Ovarium* triquetrum.

HABITUS.—Rhizomata *repentia.* Pseudo-bulbi *unifolii.* Scapus *bracteis imbricantibus* (*quarum summa maxima conduplicato-ensiformis*) *obtectus.* Flores *variegati.*

Locus artificialis inter Epidendreas, Lindl., naturalis mihi ignotus.

X. *acuminatum,** (n. sp.) sepalis acuminatis, petalis cuneato-lanceolatis, labelli lobo centrali acuminato reflexo obsolete 1-cristato.

* A second species, may be thus distinguished.

*X. roseum,** sepalis obtusis oblongis, petalis oblongis, labelli lobo centrali obtuso patente tri-cristato.

Eria rosea. *Lindl. Bot. Reg.* 12. *t.* 978. *Gen. sp. Orch. p.* 67.

It may be proper to remark that Dr. Lindley in his Gen. and Sp. places this without any specification in the body of the genus Eria, although in the Bot. Reg. l. c. he mentions the smooth flowers, and the carinate midrib of the sepals as peculiar to it.

* Char. e fig. et descr. in Bot. Reg.

HAB.—Khassya Hills, Churra Punjee, alt. 4300 feet. Flowers here in November.

DESCR.—*Rhizomata* creeping, covered with imbricated scaly sheaths. *Pseudo-bulbs* ovate, rather compressed, obsoletely 4-cornered, young ones rather scurfy. *Leaf* (one to each pseudo-bulb,) oblong-lanceolate, attenuate into a longish channelled petiole, concave, coriaceous, acute, more or less arched. *Scape* arising from the base of the last pseudo-bulb, terminating the rhizoma, a span or a foot in length; the *peduncle* almost entirely concealed by imbricated green bractes, the uppermost one being very long, conduplicate-ensiform. From the fissure of this, about its middle, emerges a short *spike* of flowers, which are of some size, prettily variegated, and of a waxy aspect. To each of the 3-5 *flowers* there is a long, (equalling the whole flower,) linear, very acuminate spreading bracte. *Perianth* ringent, posticous. *Sepals* oblong-lanceolate, acuminate, keeled along the centre of the back; the lateral oblique, forming with the foot of the column a stout gibbosity; colour brownish red with red streaks, and green keels. *Petals* flesh-coloured, pale, with reddish streaks, lanceolate, attenuate to both ends, connivent, somewhat shorter than the sepals. *Labellum* articulated with the foot of the column, tremulous, three-lobed: lateral lobes small, roundish, erect, terminal sub-lanceolate, acute, with an obsolete crest along the centre, reflexed from the middle. An oblique inconspicuous crest at the base of each of the lateral lobes. The general colour sanguineous, central lobe tawny yellow. *Column* curved (with its foot forming a hook,) white, somewhat three-toothed at the apex; teeth rounded, anticous (dorsal) one the smallest. *Rostellum* entire, short, tongue-shaped. *Anther* fleshy, two-celled; cells 4-locellar. *Pollen masses* 8, cohering by fours with a large viscous elastic powdery-looking flat body. *Ovarium* triquetrous (almost three winged,) the angles continuous with those of the sepals, reddish brown.

I met with this plant about Churra Punjee in October 1837. It was introduced into these gardens, where *Buxoo* tells me it has been called Eria carinata, by Mr. Gibson.

It appears to me impossible to force this plant into a genus so natural as that of Eria, without violating all one's ideas of natural affinities; I have therefore ventured to constitute a new one, the name of which has reference to the sword-shaped bracte-imbricated peduncle, and which will include Eria rosea of Dr. Lindley. Technically it is distinguishable from Eria by the remarkable inflorescence, the smooth perianthium, carinate sepals and triquetrous ovarium. The habit is peculiar.

I imagine it would come as an Eria into Dr. Lindley's section Tonsæ, which appears to contain more than one genus, as exemplified by Eria convallarioides, planicaulis, clavicaulis ? although these are taken from a very partial list of species.*

EXPLANATION OF PLATE XXV.
(left hand.)

Plant reduced about one-half.

1. Flower and end of the spike, natural size.
2. Flower, laterally, sepals and labellum removed.
3. The same, one petal removed.
4. Labellum, laterally.
5. Anther, underface.
6. Pollen masses, in front.
7. Column and anther, in front.
8. Ovarium, double transverse section.

All but the figure of the Plant, and No 1, more or less magnified.

APORUM.

Blume Bijd. p. 334. *t.* 39. *Lindl. Gen. sp. Orch. p.* 70. *Endl. Gen. Pl. p.* 192. *No.* 1364.

Dendrobium. *Roxb. Fl. Ind.* 3. *p.* 487. 488. *No.* 13. 14. *Icones.* 13. *t.* 72, 73.

Herba supplex. *Rumph. Hb. Amb.* 3. *t.* 51.

* Index Bot. Reg. 1838-1841.

CHAR. GEN.—*Perianthium* bilabiatum: labium superius sepalis et petalis, inferius labello formatum. *Sepala* lateralia obliqua, cum pede columnæ connata. *Petala* angustiflora. *Labellum* cum pede columnæ articulatum, indivisum vel trilobum, cristatum callosum vel nudum. *Columna* basi longe producta. *Pollinia* 4, per paria collateralia.

HABITUS.—Herbæ *epiphyticæ.* Caules *simplices vel ramosi, apice in quibusdam flagelli in modo attenuati foliis denudati florigeri.* Folia *disticha, compressissima, sæpius scalpelliformia.* Pedicelli *florum basi paleis cincti.* Inflorescentia *centrifuga, vel irregularis.* Flores *terminales vel axillares, vel in speciebus caulibus apice attenuatis quasi racemosi, invicem expandentes, inconspicui.*

Genus structura floris a Dendrobiis quibusdam, (exempli gratia D. crumenato); nullo modo diversum. Folia nullo modo equitantia.

A. *Jenkinsii* (n. sp.), caulibus spithamæis, foliis anguste scalpelliformibus obtusis subteretibus, floribus solitariis terminalibus et axillaribus, labello spathulato-obovato apice sub-truncato undulato reflexo, columnæ pede longissimo trivenio apice bifurco.

HAB.—Assam, *Major Jenkins*, by whom it was introduced into these Gardens, where it flowers in October.

DESCR.—*Stems* simple, grouped together, scarcely more than a span long. *Leaves* narrow scalpelliform, compressed, 2½ inches long, 1½ line broad, very fleshy, obtuse. *Flowers* terminal, solitary, rather large, white. *Pedicel* 1½ inch long. *Perianth* two-lipped, upper lip formed by the sepals and petals, the lower by the labellum. *Upper sepal* lanceolate-oblong: *the lateral* much broader, very oblique, united with the foot of the column. *Petals* spathulato-lanceolate, rather narrower than the third sepal, with reflexed spreading points. *Labellum* entire, ascending-reflexed, revolute to-

wards the apex, where it is emarginate; spread out spathulato-obovate, with folded or undulate margins; colour white, with a yellow line down the centre. *Column* very short, furnished with an erect small tooth on either side of the anther, with an extremely long curved foot, which is three-veined, bifurcate at the apex. *Stigma* occupying almost the whole face of the column. *Anther* sub-immersed, cucullate. *Pollinia* 4, pyriform, curved.

The flowers, which vary a good deal in size in distinct individuals, have the smell of Dendrobium crumenatum, but to a less powerful degree.

I have adhered to the usual terms in describing the column, although they are scarcely applicable, the prolonged foot belonging partly at least to the labellum and lateral sepals. Mr. Brown's character of Dendrobium, Prodr. Fl. N. Hol. p. 188, may have some reference to this, which, as it regards a diversity of origin of a structure much used in generic definitions, is worth investigation.

The following are the Indian species of this genus.

A. *Leonis,* foliis patentissimis breve et late scalpelliformibus obtusis, floribus terminalibus, labello lineari-oblongo pubescenti fimbriato-dentato apice emarginato subdilatato.

A. indivisum. *Bl. Lindl. Gen. Sp. Orch. p.* 70. A Leonis. *Lind. Bot. Reg.* 26. *misc. not. p.* 59. *No.* 126.

Hab.—Singapore. *Cumming*. Tanjong Cling. Ayer Punus (Rhim) Malacca.

Stems a span long. *Leaves* sometimes so much approximated that the stem resembles a coarse double-edged saw: varying in size, but always broadly and shortly scalpelliform. *Flowers* reddish brown (Lindl.), subsessile. *Petals* oblong-lanceolate, twice as broad as the third ovate sepal.

A. *anceps,* foliis scalpelliformibus ascendenti-patentibus acutis, floribus terminalibus vel axillaribus, labello cuneato emarginato crenulato.

A. anceps. *Lindl. Gen. sp. Orch. p.* 71. *Lodd. Bot. Cab. t.* 1895. Dendrobium anceps. *Swz. Lindl. Bot. Reg.* 15. *t.* 1239. *Roxb. Icon.* 13. *t.* 73. *Fl. Ind.* 3. *p.* 487.

Hab.—On trees, Delta of the Ganges and Irrawaddi, etc.

About a span in height. *Stems* simple or branched. *Leaves* often narrow lanceolate, *Flowers* green, or more usually brownish-ochroleucre. *Labellum* represented in Bot. Cab. with two reddish longitudinal lines.

A. *sinuatum*, " foliis lanceolatis equitateris approximatis acutis, floribus solitariis axillaribus, labello cuneato elongato intra apicem linea hippocrepica crassa sinuata circumdato."

A. sinuatum. *Lindl. Bot. Reg.* 1841. *misc. not. p.* 1. *No.* 3.

Hab.—Singapore. *Cumming.*

" It has the habit of A. anceps, but its leaves are much narrower and longer, and the flowers are pale yellowish green." *Lindl.*

A. *cuspidatum*, " foliis lanceolatis, floribus axillaribus, labello emarginato apice crispo per medium obsolete bilineato."

A. cuspidatum. *Lindl. Bot. Reg.* 1841. *misc. not. p.* 2, *No.* 7.

Sent by Dr. Wallich to Messrs. Loddiges.

A. *micranthum*, foliis lanceolato-scalpelliformibus approximatis acutis, floribus terminalibus, labello lineari-oblongo bilobo fundo appendice carnoso truncato aucto.

A. micranthum. *Griff. Calc. Journ. Nat. Hist.* 4. *p.* 375. *t.* 17.

Penang. *Mr. Lewes.*

Stem about a span high, simple. *Leaves* ascending, adpressed. *Flowers* white, minute, much smaller than in any other species. *Lobes* of the *labellum*, erroneously said (op. cit.) to be three-lobed, nulate.

A. *Roxburghii*, caule ramoso apice attenuato florigero, foliis scalpelliformibus acuminatis, floribus racemosis, labello cuneato apice trilobo crenulato lobo medio emarginato.

Dendrobium Calceolum. *Roxb. Icon.* 13. *t.* 73. *Fl. Ind.* 3. *p.* 488.

Hab.—Amboyna.

Flowers large, "dull orange, and slightly veined with dull-red." *Petals* linear spathulate, very narrow. *Labellum* represented as almost 4-lobed, or 3-lobed, with the central lobe emarginate.

The quotation from the Hb. Amb. in the Flora Indica is wrong. Roxburgh probably meant Herba supplex, t. 51. fig. 1.

The species appears to have been passed over entirely.

A. *acinaciforme*, caule ramoso apice attenuato florigero, foliis scalpelliformibus subacutis, floribus racemosis, labello obovato-cuneato emarginato leviter undulato.

Dendrobium acinaciforme. *Roxb. Icones.* 13. *t.* 72. *Fl. Ind.* 3. *p.* 487. Aporum Serra. *Lindl. Gen. sp. Orch. p.* 71. Herba supplex. *Hb. Amb. t.* 51, *f.* 2. (auct. Roxb.)

Hab.—Amboyna, *Roxburgh.*; Assam, *Major Jenkins.*

Habit much like that of A. Roxburghii. The *flowers* are however very much smaller, and yellow. *Petals* narrow lanceolate.

The Assam specimens vary a good deal, generally the stems are simple, the flowers whitish, and the labellum almost bilobed. Sometimes however the stem is branched: the leaves broader, and so compressed as to be almost flat, and the lip faintly spotted with red. In one instance the flower was solitary and terminal.

A. *subteres*, (n. sp.) caule subsimplici apice attenuato florigero, foliis distantibus subteretibus compressis arcuatis pa-

tentibus, floribus racemosis, labello spathulato emarginato plicato-undulato fundo sub-tricristato.

HABIT.—On trees. Ayer Punnus (Rhim), Malacca.

DESCR.—A slender species not exceeding a foot in height. *Stems* very flexuose, very attenuate. *Leaves* many times longer than broad. *Flowers* small. *Petals* linear spathulate, very narrow.

In general size this approaches to the Assam specimens of A. acinaciforme: it appears to be distinguished from all others, (setting aside Blume's species, the characters of which are quite insufficient,) by the narrow subterete, distant leaves.

EXPLANATION OF PLATE XXV.

(left hand.)

Aporum Jenkinsii.

Portion of a plant, natural size.

1. Flower, laterally.
2. Flower, in front.
3. Labellum and column, laterally.
4. Labellum inner surface, in front.
5. Column and anther, obliquely, part of the foot of the column, removed.
6. End of the foot of the column.
7. Column and anthers, back view.
8. Upper part of the column with the anther, in front.
9. Anther, under face.
10. Pollinia.

All but the figure of the plant more or less magnified.

EUPROBOSCIS.

CHAR. GEN.—*Perianthium* posticum, connivens, carnosum. *Sepala* lineari-oblonga, lateralia conduplicato-carinata. *Petala* anguste lanceolata, (apice reflexa.) *Labellum* simplicissimum, integerrimum, semi-convolutum, cum basi columnae obliqua continuum. *Columna* verticalis, antice in rostellum

bicrure longum attenuatum. *Stigma* verticale. *Anthera* dorsalis, rostrata. *Pollinia* 8 cerea, rotunda. *Caudicula* longissima. *Glandula* linearis.

HABITUS.—Epiphytica, *cæspitosa.* Pseudobulbi *turbinati, novelli* 2-4 *folii.* Folia *carnosa, oblonga, emarginata.* Scapus *subclavatus, erectus.* Flores *spicati,* 1-*bracteati, minuti, viridescentes.*

HAB.—Nepal, communicated by Major H. Lawrence. Flowered here in March, April, 1844.
Euproboscis pygmaea.

DESCR.—A minute plant, scarcely exceeding 4 inches in height, apparently forming thick tufts. *Pseudo-bulbs* turbinate. *Leaves* ovate-oblong, the smaller ones almost round, fleshy, emarginate, one-veined, channelled. *Scape* erect, 3-4 inches high, roundish, almost club-shaped with a few membranous sheaths. *Flowers* spiked, small, inconspicuous, green, scentless, suffulted by a small scale-shaped bracte, in bud depressed flat, two-edged. *Perianth* posticous, connivent; sepals nearly equal, oblong, fleshy, the lateral conduplicate-carinate. *Petals* narrow lanceolate, of the same length with the sepals, points recurved, spreading. *Labellum* the length of the sepals, very entire and simple, much like the petals, half-convolute, continuous with the base of the column. *Column* vertical, very short, very oblique indeed deficient behind, in front (anticously) elongated into a long rostrate two-legged rostellum. *Anther* parallel with the column, dorsal, fleshy, prolonged into a long beak. *Pollinia* 8, round, minute, incumbent in fours. *Caudicula* very long. *Gland* linear about half as long. *Ovarium* simple.

This is one of the many species that so much weaken the distinctions employed by Dr. Lindley to arrange naturally the plants of this difficult family. Its affinities appear to me to be with Neottieæ, particularly with certain pseudo-bulbed forms allied to Anœctochilus; yet its pollen masses are obviously waxy. In this respect and in the column generally, it ap-

proaches to Appendicula, the flower of which however does not depart from the ordinary structure of a natural section of Vandeæ.

I see nothing in Lindley's Gen. and Spec. approaching it technically except Appendicula, from which however it is too distinct to need any comparison.

EXPLANATION OF PLATE XXVI.

(right hand.)

Euproboscis pygmæa.

Plant, natural size.
1. Flower, obliquely.
2. Ditto, front of posticous face.
3. Flower, sepals removed.
4. Same, petals likewise removed, anther reflexed.
5. Pollen masses.

All but the figure of the Plant more or less magnified.

Correspondence.

Extract of a letter from M. Guibourt, *Professor of Pharmacy, Paris, to Dr.* Mouat, *Professor of Materia Medica, Calcutta.*

To the Editors of the Calcutta Journal of Natural History.

Dear Gentlemen—I am induced to forward to you for publication in your Journal, the enclosed extract from a letter addressed to me by Professor Guibourt of Paris, because it will be the means of widely making known, what are deemed by the first authorities in Europe, desiderata respecting the Materia Medica of India. I have succeeded in collecting a few specimens, and also some definite information respecting certain of the substances mentioned by Monsieur Guibourt; but my time is so fully and incessantly occupied in more immediate and pressing official duties, that I am quite unable, single-handed, to do justice to so important and interesting a subject. I venture, therefore, to solicit the aid and co-operation of all who take an interest in the matter, and are able from leisure and favourable position to collect specimens, and furnish me with any information concerning them. I shall be happy to defray every expense attendant upon collecting, packing, and transporting all specimens with which I may be favoured, and of acknowledging them, with the source from which they were derived, through the medium of your valuable Journal, if you will accord me your kind permission to do so.

I shall take a future opportunity of publishing the memoranda I am collecting, concerning those articles of the Indian Materia Medica, which may be introduced as efficient substitutes for the more costly drugs imported from Europe and America; as well as any which possess peculiar and valuable properties, hitherto unknown to us, or not yet established by competent and trustworthy authority. I am unwilling, however, to intrude myself upon the notice of the profession and the public with premature conclusions, or hasty, ill-conducted experiments, which subsequent trial and observation may prove to be unfounded and incorrect.

I have, &c.

FRED. J. MOUAT, M. D.

Medical College, 1st Oct. 1844. *Profr. of Materia Medica, &c.*

L'Inde est sans contredit l'une des contrées les plus riches en matière utiles à la Pharmacie, aux arts ou à l'économie domestique. Mais nous avons encore eu si peu de communications directes avec elle, que vous ne devrez pas etre étonné de notre ignorance sur des choses qui vous paraitront n offrir aucune difficulté. De plus, la situation de Calcutta, qui en fait l'entrepôt central des productions l'Asie et d'une partie de l'Afrique, nous fait espérer que vous pourrez nous donner des éclaircissementa sur des objets étrangers au Bengale, mais qui doivent y arriver par la voie du commerce. Voici donc les substances sur lesquelles je desire principalement appeler votre attention.

Costus Arabique.—Racine long tems attribuée au *Costus speciosus* de la famille des Scitaminées. J'ai montré la fausseté de cette opinion, et j'ai pensé que le Costus devait être produit par une plante Synanthéreé* voisine des Carlines. Enfin j'ai supposé que cette racine etait originaire des contrées voisines du cours de l'Indus. Il serait utile de verifier ces différentes assertions et de nous envoyer la racine du *Costus speciosus*, afin de montrer sa différence avec le Costus arabique. Celui-ci est une racine grosse comme le pouce et plus, grisatre, d'une odeur forte d'iris et de boue melangées, d'une saveur amère et un peu âcre.

Bois de Couleuvre, ou *Lignum colubrinum.*—On a donné ce nom aux racines de plusieurs végéteaux qui ont jou idaus l'Inde de la réputatiox de guérir la morsure des serpents venimeux. Nous sommes desireun de nous les procnrer toutes, et notamment les suivantes.

Racine du *Strychnos Nux Vomica.*
——— du *Strychnos colubrina*, ou *Modira Caniram* de Rheede.
——— du *Tsjeru-Katavalli-Caniram* de Rheede.
——— de *l' Ophioxylum serpentinum.*
——— de *l' Ophiorhiza Mungos.*
——— du *Soulamea amar-ea.*

* Procurable in the Botanic Gardens.

Curcuma ou *Turmeric.*—Pourrait on avoir des échantillous d'herbier des differents Curcuma cultíves à Calcutta, ou croissant naturellement au Bengale; chacune des espèces ètant accompagnée de la racine.*

Autres racines que l'on désire de procurer, avec les noms spécifiques des plantes *atch-root, bish, bishma* ou *bickma, nirbishee,* (Aconitum ferox,) *mudar,* (Asclepias gigantea, procera,) *Periploca indica, Smilax zeylanica.*

Nard Indien, ou Spicanard.—Deux racines viennent de l'Inde sous ce nom, 1° le *vrai nard jatamansi,* produit par le *Valeriana Jatamansi* ou *Nardotaschys Jatamansi,* DC. et le *nard radicant de l'Inde,* ou *nard du gange* de Dioscoride, dont l'origine est encore inconnu. Pourrait on se procurer: 1° un individu ses du *Valeriana Jatamansi,* avec sa racine; 2° un échantillon de quelques onces à une livre de *vrai nard jatamansi;* 3° un individu sec du *Valeriana Hardwickii* de Wallich, avec sa racine; 4° un individu sec du *Fedia grandiflora,* Wallich, ou *Nardostachys grandiflora.* Je soupçonne que cette espèce produit le nard radicant de l'Inde.

Rhubarb.—Dans ces dernières annèes quelques personnes ont attribués la rhubarb de Chine ou du Thibet an *Rheum australe.* Je la crois toujours produite par le *Rheum palmatum;* mais pour en être plus certain nous prions M. Mouat de nous faire parvenir des échantillons certains des racines des differénts, *Rheum* qui croissent dans l'Himalaya ou qui sont cultivés à Calcutta.†

Ecorce d'Anacarde. (Semecarpus Anacardium.)—Nous desirons beaucoup nous procurer l'écorce de cet arbre,‡ et connaitre les différents noms qúélle peut porter dans l'Inde, ainsi que les usages auxquelles on peut l'employer.

Ecorce d'Alyxie aromatique.—Ecorce blanche, aromatique, venant des iles Moluques. Elle nous manque complètement.

Ecorce de Bé-lahé.—Ecorce tres amère employée comme fébrifuge à Madagascar et aux iles Maurice. Est elle connue à Calcutta?

Autres écorces que l'on desire se procurer avec l'indication des arbres qui les fournissent:

Souroul-puttay, Naga-puttay, Konnay-puttay, Karoovelum-puttay, Kally-puttay, Marudum-puttay, Poola-puttay. Lodu-puttay, Odium-puttay, Awarai-puttay, Popli-puttay, Vaymbadum-puttay, Velum-puttay, Attico-puttay.

Bois d'Aloès.—J'ai essayé, dans *l'Historie abrégée des drogues simples,* de détruire la confusion quiexiste dans les differents bois *d'aloú,* de *calam-*

* No species of Rheum is cultivated here.

† Dr. Falconer has published this plant under the name Aucklandia Costus in a late number of the Linn. Trans. to which we have not access.

‡ Procurable in the Botanic Gardens.

bac, *da'galloche*, de *garo*, &c. et je pense avoir reconnu, soit dans les droguiers, soit dans le commerce, ceux de ces bois produits par l'*Aloexylum Agallochum*, l'*Aquilaria secundaria* ou *malaccensis*, et l'*Excœcaria Agallocha;* mais ces déterminations ont besoin d'être confirmées par des échantillons puisès dans des lieux d'origine; nous prions donc M. Mouat 1° de nous faire parvenir un échantillon de chacun des bois d'Aloù, de Calambac ou d'Agalloche que l'on trouve dans le commerce de l'Inde, avec les notions que vous pourrez recueillir sur leur origine.

2°. De nous procurer, indépendamment de cela, s'il est possible, le bois authentique de chacun des arbres suivants: *Aloexylum Agallochum*, *Aquilaria secundaria*, *Excæcaria Agallocha*,* *Michelia Champacca.*†

Santal citrin. Peut-on se procurer des échantillons certains de *Santal citrin* du *Malabar*, de la *Cochinchine* et de *Timor*, afin d'en reconnaître les différences de qualité signalées par les auteurs. Vieut-il du *Santal citrin* des iles Sandwich, où est il produit par le *Santalum Freycinetianum.*

Santal blanc à l'odeur de rose.—Jái décrit sous ce nom un bois que l'on trouve quelquefois en petite quantité dans le commerce de la droguerie à Paris. Il est en bûches peu volumineuses, cylindriques, pourvues d'une ècorce grise, assez dure et compacte. Le bois est très pesant, très dur, très compact, comme imprègnè d'huile, susceptible d'un beau poli; il a une saveur amère et une odeur de rose tres marquée. L'origine en est inconnue. Trouve t'on quelque chose de semblable dans le commerce de l'Inde?

Y trouve t'on egalement du *bois violet* et du *bois de roses* venant de la Chine?

Plusieurs ouvrages font aussi mention d'un *bois d'agra*, que l'on dit pourvu d'une odeur très agréable et être très estimé en Chine. Le connait on dans l'Inde?

Bois de Santal rouge et Caliatour.—D'après Rumphius le *Bois de Caliatour* serait le meme que le Santal rouge de l'Inde; mais on observe entre eux des différences, si constantes dans la couleur et la texture que je les regarde comme produits pour le moins par deux espèces différentes de *Pterocarpus.* Voici donc les questions que je propose de résoudre.

1°. Le *Bois de Caliatour* vient-il du Coromandel, de Ceylon, de Madagascar, ou de la côte d'Afrique? Connait on l'arbre qui le produit?

2°. Le *Bois de Santal rouge dé l'Inde (Pterocarpus Santalinus* ou *Segapooshandanum)* peut-il être distingué du *Santal rouge des iles Moluques*, que je crois produit par le *Pterocarpus indicus?*

3°. Peut on se procurer les bois du *Santal rouge d'Andaman*, produit parle *Pterocarpus dalbergioides?*

* Procurable in the Botanic Gardens. † Ditto.

4°. Peut-on se procurer les bois du *Pterocarpus flavus*, et du *Pterocarpus Marsupium?* Ces différents arbres laissent découler des sucs rouges, auxquels on a donné longtems le nom de *Sang dragon*, mais qui font probablement partie des Kinos actuels du commerce.

Autres Bois que l'on desire se procurer.

Bois rouge de l'Inde. *Inga bigemina.**

Autre bois rouge de l'Inde ou *Shem-marum. Swietenia febrifuga.*†

Bois satiné de l'Inde. *Swietenia Chloroxylon.*‡

Bois jaune de l'Australasie. *Oxleya xanthoxyla.*

Diababul de l'Inde. *Acacia arabica.*§

Carin towarai-marum.

Poorsung-marum.

Weskali-marum.

Waghai-marum.

Poollicem-marum. *Tamarindus indica.*‖

Feuilles dites, *Cassa elley*, et leur nom botanique.

Fruits ou semences huileuses nommées, *Mara-enney.*

Fruit nommé *Boa-tam-paijang* ou *Boochgaan tam-paijang*, quel est l'usage de ce fruit dans l'Inde? ai-je eu raison de l'attribuer au *Sapindus rubiginosus*, Roxb.

Lichens tinctoriaux de l'Inde. Des échantillons avec l'indication des couleurs qu'iles peuvent produire.

Produits Végétaux.

Suc d'Aloès.—Echantillons des différents aloès employés dans l'Inde, avec l'indication des coutrées et des espèces *d'aloe* qui les fournissent ainsi que le procédé d'extraction.

Opium.—Un echantillon des différents opiums commerciaux fabriqués dans l'Inde, et des détails sur la manière de les obtenir.

Cachous, Gambeers et Kinos.

Nous sommes très desireux de nous procurer des échantillons de tous les sucs astringents employés dans l'Inde, et qui sont connus en Europe sous les noms ci-dessus, et nous aurions une grande obligation à M. Mouat s'il pouvait y joindre une notice sur les contrées et les arbres qui fournissent chaque espèce. Voici principalement les sortes sur lesquelles nous dèsirons des renseignements.

1°. *Cachou de Colombo* en Ceylon.

2°. *Cachou de Mysore* nommé *Coury.*

3°. Autre *cachou de Mysore* nomme *Cassu.*

* Procurable in the Botanic Gardens. † Ditto. ‡ Ditto
§ Ditto. ‖ Ditto. ¶ Ditto. ** Ditto.

4°. *Cachous* des provinces supérieures du Gange apportés à Calcutta.

5°. *Cachou blanc* ou *Katha Suffaid.*

6°. *Cachou de Pégu* nommé aussi *Cascaty*, ou *Cashcuttie.* Quel arbre le produit ?

7°. *Cachou de Siam.*

8°. *Gambeer cubique.*

9°. *Gambeer cubique de Java.*

10.° *Gambeer prismatique jaune de Singapore*, ou *Gambeer en aiguilles.*

11°. Les differents Gambeers circulaires et *estampés* ou marques d'au cachet.

12°. *Cata gambra* du Japon.

13°. Suc astringent du *Pterocarpus Marsupium*

14°. ——————— ——————— *santalinus.*

15°. ——————— ——————— *indicus.*

16°. ——————— ——————— *dalbergioides.*

17°. ——————— *Butea frondosa.*

18°. ——————— de *L'Eucalyptus resinifera* de l'Australasie.

19° Quelle est l'origine de la substance nommée en Angleterre *East Indian Kino*, ou *Amboyna Kino ?*

20°. Quelle est l'origine du suc astringent nommé *Facaoli, Tagale* ou *Takale ?*

Sagou.—Les différentes espèces apportées par le commercé, avec leur lieu d'origine et des notions sur les arbres qui les produisent.

Gommes de l'Inde.—Les différentes gommes solubles dans l'eau et analogues à la gomme Arabique, que l'on récolte dans l'Inde, soit quelles proviennent d'Acacia, soit quelles soient tirees d'autres arbres.

Bdellium de l'Inde.—Il nous est arrivé, il ya quelques années, une gomme résine brunatre, un peu molle, que l'on a cherché à vendre sous le nom de *Myrrhe de l'Inde*, mais qui etait plutôt une sorte de bdellium. La connait on à Calcutta ?

Copal dur et Copal tendre.—De quelle contrée vient la Résin Copal qui arrive de l'Inde, et principalement de Calcutta en Europe ? En supposant que le Copal ne soit pas originaire de l'Inde, ou du Bengale, y mèlet-on, dans les entrepôts de l'Inde, quelque résine indienne ? quelle est, entrâutres, l'origine d'une résine en belles larmes ovoídes, transparentes, vitreuses et presque 'incolores, que l'on trouve mèlée au copal ?

Peut t'on se procurer la résine du *Vateria indica* on *Elæocarpus copalliferus ?* et celle des différents *Dammara* des iles Moluques, surtout la résine du *Pinus Dammara* ou *Dammara alba* de Rumphius ?

De même celles des *Canarium*, *Amyris* et autres arbres résineux de l'Inde ou des îles Moluques?

Gomme Gutte—Pourroit ou enfin connaitre par un échantillon authentique avec fleurs et fruits, l'arbre dont ou extrait la Gomme Gutte dans le pays de Pegu et de Siam? Trouve ton de la gomme gutte extraite du *Carcapuli*, *Cambogia Gutta*, L. ou *Garcinia Cambogia*, DC.? et de la gomme gutte de Ceylon extraite du *Garcinia Morella*, DC. ou *Hebradendron cambogioides* de Graham?

Résine Laque.—De quelle partie de l'Inde vient principalement la résine Laque? Sur quels arbres la trouve-t-on principalement? Quel est, entr' autres, l'arbre qui produit la *Laque en bâtons de Mysore*, nommée je crois *Komburruk?* Quelle preparation fait-on subir à la laque pour la convertir en *Laque plate* ou *Laque en écailles*, ou pour fabriquer le *Lac-laque* et *Lac dye?*

Styrax liquide.—Cette substance fait elle partie de la matière médicale de l'Inde? De quelle contrée la tire t' on? Quel arbre la produit?

Benjoin.—Se procurer des échantillons des différentes sortes de Benjoin du commerce à Calcutta, avec leur lieu d'origine.

Camphre de Bornéo, du *Dryobalanops Camphora*, et *Huile de camphre* du meme.

Monsieur.

Je crains que l'étendue des notes précédentes, le nombre de demandes qui vous sont faites ne vous fassent repentir de vos offres de service, vous voyez, dans tous les cas, que nous ne sommes pas gens à négliger celles qui nous sont faites. Nous vous faisons nos excuses d'en user si librement avec vous, et nous recevrons avec reconnaissance les communications que vous voudrez bien nous faire, relatives aux sujets demandés, ou à tous les autres qui vous paraîtront devoir fixer notre attention.

Je suis, Monsieur et honoré confrère, avec la plus parfaite consideration.

Votre tres humble serviteur,

G. Guibourt,

Paris, Rue Fedeau, No. 22. *Professeur à l'Ecole de Parmacie.*

Note on the Snow Line on the Himalaya. By Capt. T. Hutton, *Bengal Army.*

It would appear from Captain Jack's remarks in No. 15 of this Journal, relative to my paper on the snow line of the Himalaya, that I have inadvertently allowed myself to be misunderstood. The truth of

the main point for which I contended, is admitted by Captain Jack, and likewise I suspect by yourself, namely that *the snow lies no longer deeper and lower down on the Northern aspect of "the Himalaya," than it does on the Southern aspect;* this being admitted, the minor points may be easily disposed of.*

Captain Jack objects to my stating that "dense forests and vegetation occur along the Southern slopes while they are nearly altogether wanting on the Northern face;" in making this statement, I referred, not to the Southern slopes of *secondary or minor ranges on the Cis-Himalayan aspect,* but to the fact that forests and dense vegetation are found on the South of the principal chain or true Himalaya, while on the Northern aspect of that great range they are nearly altogether wanting. This assertion will, I doubt not, be borne out by every one who has crossed into Tartary: for while to the South of the great chain we find superb and stately forests, on the North there is scarcely a tree to be seen, and the few that are occasionally met with are either stunted Cypresses growing in the moist soil of ravines, or poplars planted round a village by the hand of man for economical purposes.

The reason why the minor ranges South of the Himalaya are clothed with forests on their Northern aspect is, I think, to be attributed to the fact that the dip of the strata being to the North or North-east, affords abundant soil on that side for the growth of vegetation, while the Southern out-crop, on the other hand, generally presents a bare and rocky escarpment on which little else than grasses and ferns can find soil enough to nourish them. North of the Western Himalaya, however, be the dip to whatever point it my, *there are no forests at all.*

In saying that vegetation *attracted* moisture, I have probably erred, and I thank Captain Jack for the courteous manner in which he has pointed out my mistake. I should rather have said that as vegetation is known to absorb or imbide moisture without which it cannot flourish, so the actual presence of dense forests proves, that the Southern climate is damper than the Northern one, which, coupled with the facts that the sun has less power on the northern aspect, and that the periodical rains do not extend thither, seems, according to my idea, a

* The difference between Captains Jack and Hutton, is rather a difference about words than any real difference of opinion as to the fact, Captain Hutton having inadvertently omitted in the first instance to distinguish according to conventional terms, the aspect of the Principal Mountain Chain of the Himalaya, from that of the Principal mountain groups, subordinate groups, and mountains—Geographical terms, the use of which is essential to the clear understanding of the question.—Ed.

farther reason for the longer continuance of the snow on the North than on the South.

The last number of the Journal contains some remarks on this subject from Mr. Batten, who appears to disagree with me '*in toto.*' I do not however see any reason to alter what I have said, especially since my statements are fully corroborated by the observations of Captains Cunningham and Jack, made in the year 1842, in different parts of the Himalaya and likewise at different seasons. It appears to me that Mr. Batten's desire to convince you that "*every one who has visited the Himalaya,*" does not hold opinions opposed to those of Captain Webb, has lead him into something very like a contradiction of his own opinions, a refutation in fact of his own doctrines, for he starts with an assertion that "*the perpetual snow line is at a higher elevation on the Northern slope of* "*the Himalaya*" *than on the Southern slope ;*" although immediately afterwards he "willingly allows that the North side of a hill retains the snow longer and deeper than the South side, and this observation equally applies in Bhote."

Now if the snow lies longer on the north than on the south, and if there be any eternal snows, it is clear, that it must be found on the northern aspect and not on the southern, which is precisely what I have endeavoured to prove.

Mr. Batten says "that at the same moment of time, (say of any day in September) when in Thibet, or Chinese Tartary, little or no snow is found; at 17,000 or even 18,000 *feet odd* above the sea by one traveller, another traveller in the Himalaya on the south side of the high peaks finds deep snow at 14,000 feet and *even lower.*" Now Captain Jack's observations bear rather strongly on this very point, and prove the reverse of Mr. Batten's statement, for he says, that he "crossed the Borendo Ghat, *on the 25th September* 1842, and there was no snow at all on the southern aspect, or on the very summit of the Pass; but descending a few yards on the northern aspect, to the base of a rock which was nearly perpendicular, he had the pleasure of seeing his baggage, &c. descending most rapidly by their own gravity, upon an unbroken bed of snow extending 250 to 300 yards in one slope, forming an angle of about 45°."

Another traveller in these regions, the well known and enterprising Dr. Gerard, has stated, "that the line (of perpetual snow) in the latitude 30° 30′ in Asia is fixable at 15,000 feet on the Southern or Indian aspect of the Himalaya mountains, and on the northern (not the Tartaric) may be concluded at 14,500 feet. This gives a difference of 500 feet in favour of the northern side. Dr. Gerard then proceeds to state, that

"the Haus Bussun is the last pinnacle of the chain before it is broken by the Sutlej, and could not have been more than five miles from him, but it was not visible from where he then was, on the Borendo Pass. The cheebs of the Pass are perfectly naked long before this time of the year, (August 1822,) and the trough formed by them, although sheeted with snow at the summer solstice, is now, (August,) bare rock down to the ravine on the south side, with the exception of some accumulations, which will be very much diminished before another month; *and some seasons*, as the former (1821,) *the whole face of the declivity is without a patch of snow. On the north side there lies a vast field which never dissolves.* At about 1,000 feet below the crest it breaks up, but continues in slips and scattered masses to the bottom of the dell, or where the stream finds a regular channel at 13,500 *feet;* and where the cliffs are steep, it occurs *at a much lower* level." (*Lloyd and Gerard's Tours in the Himalaya, p.* 327-328.)

These observations then appear to furnish a complete answer to Mr. Batten's challenge, and prove that the perpetual snow line must be looked for on the Northern aspect of the mountains, as it is evident from the facts mentioned by Captain Jack, Dr. Gerard, Dr. Lord, Captain Cunningham and myself, that the snow in some seasons deserts the Southern aspect altogether, and consequently that *there is no perpetual snow on the Southern aspects;* it may perhaps sometimes last for several years without entirely disappearing, but yet there are occasional seasons in which the whole Southern snow of particular localities is dissolved; and thus at once destroys its right to be called *eternal;* on the northern side of the high peaks it *never entirely melts*, and consequently the perpetual snow occurs only on that aspect. A person may therefore reside several years in these hills without seeing the whole of the Southern side uncovered at one time, although every year he may witness the denudation of some localities on that aspect, and thus he may be led to suppose that the southern snows are eternal, an opinion which is above shewn to be erroneous.

The mere continuance of snow on any spot does not suppose that snow never melts there. Were that the case, a progressive and unceasing accumulation would be the result; the position of the *snow line*, or what is often erroneously called *the line of perpetual congelation*, is determined solely by this circumstance, that during one complete revolution of the seasons, or in the course of a year, *the snow which falls is just melted, and no more.*"*

* Professor Forbes' Travels through the Alps, p. 18.

Mr. Batten asks, "*How can any facts of one observer in one place falsify the facts of another observer in another place?*" Had I been unsupported by good authority, I should long have hesitated to array my own opinions against those of Captain Webb, but when I found that *the facts which I had seen* were corroborated by the testimony of Dr. Lord and Captain Cunningham, I should have been to blame had I not come forward, and made at least *an attempt* to set the matter in its proper light. The observations are no longer those "*of one individual in one place*," but of several competent observers in different parts of the mountains, and extend in fact from the Hindoo Koosh to the banks of the Ganges. Different travellers in different years, or even in different parts of the range in the same year,—may differ as to the amount of snow to be met with on the Southern aspect; but a series of observations made through several successive years along the whole range, would assuredly prove, that in no part of the Southern aspect was *the snow perpetual, bi-ennial* or *sept-ennial*, or for any term of years it may it some places rest, but sooner or later it will fade away, and prove that *the only perpetual snow line is on the Northern aspect.*

I trust, therefore Mr. Batten will forgive me for repeating that I believe the hitherto received opinion to be erroneous, and that it has been fully proved from the testimony of trustworthy and able observers, that *the snow lies longer and deeper, and lower down on the northern aspect of the Himalaya, than it does on the Southern side.*

THOMAS HUTTON, *Capt.*
Mussooree, 21st February, 1844. *Bengal Army.*

From J. H. BATTEN, *Esq. C. S. to* J. M'CLELLAND, *Bengal Medical Service, in reply to Capt.* HUTTON'S *remarks on the line of Perpetual Snow in the July Number of the Calcutta Journal Natural History* 1843, *Dated Camp, Kaleedoongee, Kemaon, December 9th* 1843.*

MY DEAR SIR,—I have had the pleasure of receiving your polite and kind note dated the 17th ultimo, and I beg you to accept my best acknowledgments for the liberal tone shewn in your explanation of the note appended by you to Captain Hutton's paper.

* This letter has been kept back with a view of publishing at once all that is to be said on both sides of the question. It should have appeared in the last number, but from the quantity of matter previously in type, we had not room for it as well as Captain Hutton's letter on the same subject, which we were anxious should both appear at the same time.—ED.

2. I have not been able to procure a sight of Captain Jack's notes; but, unless that gentleman takes up a totally different ground to that on which Captain Hutton bases his arguments, there can be nothing for me to discuss in opposition to him.

3. On a second perusal of Captain Hutton's article in your July Number, I find that he *can* only be understood to debate the question whether snow lies deepest and longest on the Northern or the Southern slopes of the *several* heights in the snowy range, and the mountainous tract which that range crowns; and that he does not in reality (though in appearance he does) attack the observations of Webb and others concerning the *fact*, that *on the Northern slope of the Himalya the line of perpetual snow is not so low as on the Southern slope.* I am now convinced that Captain Hutton confounds the singular with the plural number; viz. *slope* with *slopes*. The following extract from his paper shews, that he considers the Northern side of *every* hill in these mountains, that is, in Bissehr, Sirmoor, Bareh, Thakooraiën, Gurhwal, Kumaon, the Neipal Territories, &c. &c.) to be the Northern slope of the Himalya! and the Southern slope of *every* hill to be *(exclusive of its Northern side)* the Southern slope of the Himalya!!

Extract.

"But the same facts which are here insisted on as facts, are observable at Simla, without travelling even to the Snowy range; *for*, (the Italics are mine) it is notorious to all who have visited the hills, that the snow lies longest on the Northern face of Mt. Jacko than on any other part of it." He then mentions the result of a snow storm in the spring of 1836, which was visible in May, and adds, "The same facts are well known likewise at Mussooree." Allow *me* to add, *and to every man, woman* and *child*, at *Almorah* and *at every human habitation in the whole Northern hemisphere, where snow is ever seen at all.* This very day the ladies and gentlemen now freezing in the snow at Nynee Tal would doubtless, be very happy to find themselves on the Southern side of Ayâr Pâta;—but still, though on the North side of one hill in the Ghagur range, they are, I dare say, rejoicing that they are not on the Northern slope of the Himalya. This same Ghagur range, by the way, is notorious (like Jacko) for the snow on its Northern face, as those who look out of their windows at Almorah can testify, and still more those who have been snowed up at the Ramgurh bungalow, or who have slidden and slipped down the icy road thereunto.

4. If a person living at any one of the hill stations is able without travelling to support Captain Hutton's arguments, he and I evidently cannot be discussing the same subject; and I have, I fear, made an

useless parade in my first letter of all my Himalyan wanderings. Vain, also, *in regard to Captain Hutton and his seconders*, have been the travels, surveys and writings of Moorcroft, the Gerards, Webb, Hodgson, Herbert and Traill. These distinguished men conceived that the Northern slope of the Himalya meant the high land in Chinese Tartary and Thibet, (including some part of Kunawur and the Bhote Mehals which lie North of the greatest peaks); and it never entered into their minds to conceive that the Northern *Kuds* of Simla and Mussooree were a part of the Northern slope of the Himalya. The commonest book on Geology or Geography distinguishes between the side of the Himalya which faces India, and that which faces Chinese Tartary. The very Hand Books and the Primers of Zoological and Botanical Science take care to separate the *Habitat* 'Himalya' from the Habitats Neipal, Kumaon, &c. Mr. Hodgson never confounds Cachar with the Lower Hills, still less Lassa with Katmandoo. If we allow 80 miles of slope between the high snowy peaks and the plains of India, (the actual distance,) we may surely allow 80 miles to form a slope on the Tartaric side, however gentle it may be in comparison. But I do not require even 50 miles on that side. All the phenomena for which I contend, are to be found within that distance.

5. Here I might end, having shewn Captain Hutton (and I will add yourself, in revenge for your note against the Kumaonees,) the danger of mis-stating the language of others, as such a mis-statement or misinterpretation is likely to be followed by the argument of *reductio ad absurdum* against the language and reasoning of the thoughtless objectors themselves. But, it is just possible that Capt. Hutton really means something which the common interpretation of his language does not allow, and, as I have before said, appearances are against him. As this gentleman may, perhaps, be taken as an authority, it becomes necessary to be very explicit as a counter-authority, and I rely fully on your promise to publish my statements in this letter, as you did those of Captains Hutton and Jack.

6. *Firstly.*—I assert that among scientific men the Himalyan range means the chain of *highest* elevation in the mountains which form the Northern boundary of India.

Secondly.—That in this chain some of the peaks are flanked by the beds of rivers which rise on their Northern side, while others are not so flanked, but send off rivers, to join those flowing to the Ocean, from their Southern bases. They also, of course, send off rivers on their Northern side to join flanking drains. That, of the former class of peaks are those at Gungootree, Buddrinath, and Melum, where Passes

by river beds penetrate the Himalya; viz. the Neelung, the Mána and the Juwahir Passes. That, of the latter class of peaks are Bunderpooch, at the foot of which rises the Jumna, Kedarnath at the source of the Mundaknee, and Nundadevi at the source of the Pindur.

Thirdly.—That where the Passes by river beds occur, there, a marked difference exists between the Northern and Southern *extended bases* of the *same* peaks, the side to India being more steep and always quite impassable at a lower elevation, ; the side to Tartary at a higher elevation and on easier ground, being passable by men and cattle in the summer months

Fourthly.—That from 1st July to 1st October as a general rule, and universally from 15th July to 15th* September, whole tracts of country lying North of the high chain of the Himalya elevated from 15,000 to 19,000 feet above the sea, are found free from snow, (except in crevices,) that human habitations and markets thronged with traders exist at 15,000 feet and even above that height, and that high roads for traffic with pasture for cattle and bushes for fuel, cross *snow-less* elevations of 17,000 feet odd.†

Fifthly.—That none of the phenomena described under the last head are found on the Southern side of the Great Himalyan Chain.

7. It is easy to add comments to these assertions. In any September, compare the spot called the Pinduree Glaciers (11,000 feet,) with Melum, the same height. One place all ice, the other all fields and habitations. Compare the crest of the Mana Pass (18,000 feet) with Maha Punt behind Kedarnath temple, the former a high road from Mana to Dápa, Toling, &c., the latter a place of death amongst "thick ribbed ice" for pilgrims at a short distance from the temple, height of temple (11,300 feet) certainly at less than 15,000 feet. How very few villages are there found above 9,000 feet in any part of the Cis-Himalyan Mountains. How many towns and marts are there near the sources of the Sutlej, overhanging the ravine of that river, (calculated by Moorcroft and Webb to be 15,000 feet above the sea.) Dapa, Doompoo, Keoong-lung, Misser, &c. Tuklakote, East of the Manessurovur Lake, on the upper Gogra, is supposed to be at least 15,000 feet above the sea; and the Pergunnah of *Preoung*, of which it is the capital, is certainly

* This is the only period at which the perpetual snow line can be discovered, that is, after the melting of winter snow, and the first falls of the Autumn.

† This is quite conclusive of the higher elevation of snow on the Thibetan side; as there are no inhabited plateaus at such an elevation on the south side, as far as we know.—Ed.

a more fertile tract than the Kuimaon, Pergunnans of Dharma and Becanse-Bhote, which must be crossed to reach it. These very Bhote Mehals which I have previously quoted as exemplifying the Northern phenomena, are, because lying South of the Passes, or Water's beds, from which rivers flow to the North, (though lying North of the Great Peaks) uninhabitable except for five months of the year. The places in Thibet above named, besides Gurtokh, Roodukh, &c., are inhabited throughout the year.

8. But my illustrations are not required. I am only one witness, and that a very humble one. If you will open Montgomery Martin's History of the British Colonies, vol. i, *Asia*, (my copy is the second edition,) pages 95 to 110, you will find an accurate account of the country on both sides of the Himalya supported by authority, and the contrast between the North and South side is particularly described. *There*, all the allusions are to Upper Kunawur and the country beyond it, (Capt. Hutton's *own* Kunawur,) and not to Heoondes behind Kumaon and Gurhwal,—so that Capt. Webb, and others are additional and independent authorities for the same kind of facts. The Kumaonees, too, are the more valuable authorities, as the highest peaks* of the surveyed tract between the Kalee and Sutlej are situated in Kumaon, and our Passes at once take us into Thibet, and do not conduct us like those beyond Simla into an intermediate and peculiar tract, like Kunawur. I also particularly request your attention to Royle's Illustrations of Himalyan Botany, first ed. (1833,) vol. i. pp. 32 to 40; vol. iii. pp. xviii xix. xx.; vol. xi. pp. xxi xxii. and xxiii. The Roman Numbers shew that the remarks are a part of the Introduction. The Arabic Numbers denote a part of the actual work; but the Index of any edition will be a sufficient guide. The mere reprint of Dr. Royle's admirable observations would in fact be a sufficient reply to Capt. Hutton, (I would particularly request *his* attention to the account of *Zinchin* by the Gerards,) that is, always supposing that he and Capt. Jack are really attacking Webb, Herbert, &c., and do not confine their facts and remarks to Mounts *Huttoo* and *Jacko* in the Simla territory.

I remain, My dear Sir,
Your's very faithfully,
J. H. Batten

Camp. Kaleedoongee, Kumaon, Terrai, Dec. 9th 1843.

* Nundidevi is 25,750 feet, and the rest in proportion. The Western Peaks rarely attain 21.500 feet. and the Passes do not exceed 18,000 feet. and are often lower.

P. S.—The *causes* of the phenomena discussed in this letter, as also of those connected with the forests and general appearance of the hills in the Mountain Provinces (I mean in regard to Northern and Southern exposures,) ought to form the subject of another article; which, if you like, I will write, but these things have all been accounted for by better men.

Memoir of William MACLURE, *Esq. By Dr.* S. M. MORTON.

[From the Journal of the Academy of Sciences, Philadelphia.]

The most pleasing province of Biography is that which commemorates the sway of the affections. These, however, variously expressed, tend to the diffusion of Religion, of Virtue and of Knowledge, and consequently of Happiness. He who feeds the hungry, or soothes the sorrowful, or encourages merit, or disseminates truth, justly claims the respect and gratitude of the age in which he lives, and consecrates his name in the bosom of posterity. The benefactions of a liberal mind not only do good of themselves, but incite the same spirit in others; for who can behold the happy results of useful and benevolent enterprise, and not feel the godlike impulse to participate in and extent them?

The study of Natural History in this country, though late in attracting general attention, has expanded with surprising rapidity. Thirty years ago all our naturalists were embraced in a few cultivators of Botany and Mineralogy, while the other branches were comparatively unheeded and unknown. The vast field of inquiry was devoid of labourers, excepting here and there a solitary individual who pursued the sequestered paths of Science, filled with an enthusiasm of which the busy world knew nothing. How widely different is the scene which *now* presents itself to our view! Behold the multitude which throngs that once neglected arena, and mark the cheering results! We see the unbounded resources of the land brought forth to the light of day, and made to minister to the wants and the intelligence of humanity. Every

region is explored, every locality is anxiously searched for new objects of utility, or new sources of study and instruction.

In connection with these gratifying facts, it will be reasonably inquired, who were they who fostered the early infancy of Science in our country? Who were they who stood forth, unmindful of the sneer of ignorance and the frown of prejudice, to unveil the fascinating truths of Nature?

Among the most zealous and efficient of these pioneers of discovery was William Maclure.

This gentleman, the son of David and Ann Maclure, was born at Ayr in Scotland, in the year 1763; and he there received the primary part of his education under the charge of Mr. Douglas, an intelligent teacher, who was especially reputed for classical and mathematical attainments. His pupil's strong mind readily acquired the several branches of a liberal education; but he has often remarked, that from childhood he was disposed to reject the learning of the schools for the simpler and more attractive truths of natural history. The active duties of life, however, soon engrossed his time and attention; and at the early age of nineteen years he visited the United States with a view to mercantile employment. He landed in the city of New York; and having made the requisite arrangements, returned without delay to London, where he commenced his career of commercial enterprise as a partner in the house of Miller, Hart & Co. He devoted himself to business with great assiduity, and speedily reaped a corresponding reward. In the year 1796, he again visited America, in order to arrange some unsettled business of the parent establishment: but in 1803 we find him once more in England, not, however, as a merchant, but in the capacity of a public functionary; for Mr. Maclure was at this time appointed a commissioner to settle the claims of American citizens on the government of France, for spoliations committed during the revolution in that country. In this arduous and responsible trust, Mr. Maclure was associ-

ed with two colleagues, John Fenton Mercer and Cox Barnet, Esqs.; and by the ability and diligence of this commission, the object of their appointment was accomplished to general satisfaction.

During the few years which Mr. Maclure passed on the Continent in attention to these concerns, he took occasion to visit many parts of Europe for the purpose of collecting objects in Natural History, and forwarding them to the United States—which from his boyhood had been to him the land of promise, and subsequently his adopted country. With this design, he traversed the most interesting portions of the old world, from the Mediterranean Sea to the Baltic, and from the British Islands to Bohemia. Geology had become the engrossing study of his mind; and he pursued it with an enthusiasm and success to which time, toil and distance presented but temporary obstacles.

Instructed by these researches, Mr. Maclure was prepared, on his return to the United States, to commence a most important scientific enterprise, and one which he had long contemplated as the great object of his ambition, viz.: a Geological Survey of the United States.

In this extraordinary undertaking we have a forcible example of what individual effort can accomplish, unsustained by government patronage, and unassisted by collateral aids. At a time when scientific pursuits were little known and still less appreciated in this country, he commenced his herculean task. He went forth with his hammer in his hand and his wallet on his shoulder, pursuing his researches in every direction, often amid pathless tracts and dreary solitudes, until he had crossed and recrossed the Alleghany mountains no less than fifty times. He encountered all the privations of hunger, thirst, fatigue and exposure, month after month, and year after year, until his indomitable spirit had conquered every difficulty, and crowned his enterprise success.

Mr. Maclure's observations were made in almost every state and territory in the Union, from the river St. Lawrence to the Gulf of Mexico; and the Memoir which embraced his accumulated facts, was at length submitted to the American Philosophical Society, and printed in their Transactions for the year 1809.*

Novel as this work was, and replete with important details, its author did not suspend his researches with its publication, but resumed them on a yet more extended scale, in order to obtain additional materials, and test the correctness of his previous views. In after life he often recurred with pleasure to the incidents connected with this survey; some of which, though vexatious at the time, were subsequently the theme of amusing anecdote. When travelling in some remote districts, the unlettered inhabitants seeing him engaged in breaking the rocks with his hammer, supposed him to be a lunatic who had escaped from confinement; and on one occasion, as he drew near a public house, the inmates, being informed of his approach, took refuge in-doors, and closing the entrance held a parley from the windows, until they were at length convinced that the stranger could be safely admitted.

Incidents of this kind, and many others which occurred to him, appear to have influenced the following remarks in the Preface to his Geology: "All inquiry into the nature and properties of rocks, or the relative situation they occupy on the surface of the earth, has been much neglected. It is only since a few years that it has been thought worth the attention of either the learned or unlearned; and even now a great proportion of both treat such investigations with contempt, as beneath their notice. Why mankind should have so long neglected to acquire knowledge so use-

* This memoir is entitled, "Observations on the Geology of the United States, explanatory of a Geological Map." It was read January 20, 1809, and is published in the sixth volume of the Society's Transactions.

ful to the progress of civilization—why the substances over which they have been daily stumbling, and without whose aid they could not exercise any one art or profession, should be the last to occupy their attention—is one of those problems perhaps only to be solved by an analysis of the nature and origin of the power of the few over the many."

Notwithstanding that Mr. Maclure thus felt himself almost alone in his pursuits in this country, he did not relax his ardour in the cause of science, but continued to extend and complete his Geological survey; which, after receiving his final revisions, was again presented to the Philosophical Society on the 16th of May, 1817, eight years after their reception of the original draft. The amended memoir was now republished, both in the Society's Transactions and in a separate volume, accompanied by a coloured map and sections; and while it placed its author among the first of living Geologists, excited a thirst for inquiry and comparison which has continued to extend its influence over every section of our Country.

It is not proposed, in this place, to analyze this valuable contribution to American Science. It may be sufficient to remark, that every one conversant with Geology is surprised at the number and accuracy of Mr. Maclure's observations; for the many surveys which have been recently conducted in almost every State in the Union, have only tended to confirm his correctness as to the extent and relative position of the leading Geological formations of this Country; while the genius and industry which could accomplish so much, must command the lasting respect and admiration of those who can appreciate the triumphs of Science. In the evening of his days Mr. Maclure beheld with unmixed pleasure, the progress of Geology in his adopted country: he saw State after State directing Geological surveys under the supervision of zealous and able naturalists: he rejoiced to observe how their observations harmonized with his own; and it was

among his most pleasing reflections, as age and infirmity drew near, that he had once trodden almost solitary and unheeded, that path which is now thronged with votaries of science and aspirants for honour.

In truth, what among temporal considerations is more remarkable and gratifying than the progress which has been made in elucidating the Geology of this country during the past thirty years? So extended a field, so many obstacles, and so little patronage, seemed at first view to present insuperable difficulties; and it was feared, and not without reason, that while every part of Europe was explored under the patronage of national governments, the vast natural resources of this country would long remain unsearched and unimproved; not for the want of zeal and talent, but from a deficiency of that encouragement which is necessary to great and persevering exertion. Happily, however, the day of doubt has passed; and our State governments now vie with each other in revealing those buried treasures which minister so largely to the wealth, the comfort and the intelligence of man.*

The time which Mr. Maclure allotted to repose from his Geological pursuits was chiefly passed in Philadelphia; where he watched the rise of a young but promising institution, devoted exclusively to Natural History, and numbering among its members whatever our city then possessed of scientific taste and talent. This institution was the Academy of Natural Sciences of Philadelphia; and as its history, from this period, is inseparably connected with the life of Mr. Maclure, let us pause and inquire into its origin and progress.

The Academy was founded in January, 1812, at which period a few gentlemen, at first but seven in number, resolv-

* We hope a day may yet arrive when this example will not be lost, as it has been hitherto, upon the Government of India.—Ed.

d to meet once in every week for the purpose of conversing n scientific subjects, and thus communicating to each other he results of their reading, observation and reflection.

Although Mr. Maclure was absent from the city at the nitiatory meeting, he had no sooner returned than his name vas enrolled on the list of members; and from that hour, ind with this circumstance, the prosperity of the institution commenced. Arrangements were soon after entered into for the delivery of courses of lectures, chiefly on Chemistry and Botany; and the library and museum were at once replenished with books and specimens from Mr. Maclure's European collections.

On the 30th of December, 1817, Mr. Maclure was elected President of the Academy; to which office of confidence and honour he was annually re-elected up to the time of his death, a period of more than twenty-two years.

Under his auspices the Journal of the Academy (which now numbers eight octavo volumes) was commenced with energy and talent; and such was his interest in its progress, that a considerable portion of the first volume was printed in an apartment of his own house.

Among the most ardent of Mr. Maclure's colleagues at this time was Mr. Thomas Say, a gentleman who united in a remarkable degree the love of science and the social virtues. Enthusiastic in his favourite studies, and possessed of a singular tact for detecting the varied relations of organized beings, he early attracted the notice and secured the esteem of Mr. Maclure; and the friendship which thus grew up between them, continued unaltered by time or circumstance to the end of life. How much the Academy and the cause of Natural History owe to the united efforts of these gentlemen, I need not declare; for not only here, but wherever their favourite pursuits are loved and cultivated, their names will be inseparably interwoven with the records and the honours of science

During the year 1817 Mr. Maclure chiefly occupied himself in the publication of his Geology in a separate volume; after which he devoted himself with assiduity to the interests of the Academy. Previous to the year 1819 he had already presented the institution with the larger part of the fine library he had collected in Europe, embracing nearly fifteen hundred volumes; among which were six hundred quartos and one hundred and forty-six folios on Natural History, Antiquities, the Fine Arts, Voyages and Travels. "The value of these acquisitions was greatly enhanced by the fact that they were possessed by no other institution on this side of the Atlantic. The Academy therefore derived from this source a prosperity and permanence which, under other circumstances, must have been extremely slow and uncertain; while Science at the same time received an impulse which has never faltered, and which has been subsequently imparted to every section of our country."*

In the winter of 1816-17 Mr. Maclure visited the West Indies, for the purpose of ascertaining, by personal observation, the Geology of that chain of islands known as the Antilles. With this view he visited and examined nearly twenty of these islands in the Carribean Sea, from Barbadoes to Santa Cruz and St Thomas inclusive. He bestowed especial attention on those portions of the series which are of volcanic origin, of which the Grenadines form the southern and Saba the northern end of the chain. The results of this voyage of observation, in which he was accompanied by his friend Mr. Lesueur, were submitted to the Academy on the 28th of October 1817, and soon afterwards published in the Society's Journal.†

In 1819 Mr. Maclure's active mind was again directed to Europe. Embarking at New York he went direct to France, and not long afterwards to Spain. He was induced

* Notice of the Academy of Natural Sciences, p. 13.

† Journal of the Academy of Natural Sciences, vol. i.

to visit the latter country on account of the liberal constitution promulgated by the Cortes, which promised a comparatively free government to a country long oppressed by every species of bondage. His plan was to establish a great agricultural school, in which physical labour should be combined with moral and intellectual culture. His views were almost exclusively directed to the lower and consequently uneducated classes, whom he hoped to elevate above the thraldom to which they had been subjected by the institutions of their country. He purchased of the government 10,000 acres of land near the city of Alicant; and having repaired the buildings, and placed the estate in complete order, he prepared to commence his scheme of practical benevolence. Scarcely, however, were these arrangements made when the Constitutional government was overthrown, and the old institutions, with all their abuses, were again imposed upon this unfortunate country. The property which Mr. Maclure had purchased from the Cortes had been confiscated from the Church; and as the priesthood were now reinvested in their estates, they at once dispossessed him without ceremony or reimbursement.

Disappointed and mortified by this adverse termination of his plans, Mr. Maclure abandoned them as hopeless, and prepared to return to the United States. Before doing so, however, he visited various parts of southern Spain with a view to scientific investigation. But even in this unoffending employment he found himself surrounded by new dangers, which compelled him to relinquish much that he had proposed to accomplish in these researches; and his feelings, and the causes which gave rise to them, are forcibly expressed in a letter to his friend Professor Silliman, dated Alicant, March 6, 1824.

"I have been much disappointed in being prevented from executing my Mineralogical excursions in Spain, by the bands of powerful robbers that have long infested the

astonishingly extended surface of uncultivated and inhospitable wilds in this naturally delightful country. Not that I require any money worth the robbing to supply me with all that I need—for the regimen which I adopt for the promotion of my health, demands nothing but water and a very small quantity of the most common food—but these barbarians have adopted the Algerine system of taking you as a slave, to the mountains, where they exact a ransom of as many thousand dollars as they conceive the property you possess will enable you to pay."*

On returning to the United States in 1824, Mr. Maclure was still intent on establishing an Agricultural School, a plan similar to that he had attempted in Spain. At this juncture the settlement at New-Harmony, in Indiana, had been purchased by the eccentric author of the Social System; and many intelligent persons, deceived by a plausible theory, went forth to join the Utopian colony; and Mr. Maclure himself, willing to test the validity of a system which seemed to promise something for human advantage, resolved to establish, in the same locality, his proposed Agricultural School. He did not, at the same time, adopt all the peculiar views of this fugitive community, to many of which, *in fact*, he was decidedly opposed; but he consented *to compromise* a part of his own opinions in order to accomplish, in his own phrase, "the greatest good for the greatest number." For this purpose he forwarded to New Harmony his private library, philosophical instruments and collections in Natural History, designing, by these and other means, to make that locality the centre of education in the West. That the Social scheme was speedily and entirely abortive, is a fact familiar to every one; but Mr. Maclure having purchased extensive tracts of land in the town and vicinity of New Harmony, continued to reside there for several years, in the hope of bringing his school into practical operation.

* American Journal of Sciences, vol. viii, p. 187.

In leaving Philadelphia for New Harmony, Mr. Maclure induced several distinguished naturalists to bear him company, as coadjutors in his educational designs; and among them were Mr. Say, Mr. Lesueur, Dr. Troost, and a few others who had already earned an enviable scientific reputation.

For various reasons, which need not be discussed in this place, the School did not fulfil the expectations of its founder, who was at length constrained to relinquish it; and the less reluctantly as the approach of age, and the increasing delicacy of his constitution, admonished him of the necessity of seeking a more genial climate. We accordingly find him, in the autumn of 1827, embarking for Mexico in company with his friend Mr. Say. They passed the winter in that delightful country; and employed their time in observing and recording the various new facts in science which there presented themselves; and on the approach of summer they returned to the United States.

Mr. Maclure was so pleased with the climate of Mexico, and so solicitous to study the social and political institutions of that country, that he determined to return the same year; and with this intent he visited Philadelphia, proceeded thence to New Haven, and presided for the last time at a meeting of the American Geological Society in that city on the 17th of November, 1828. Of this institution he had also long been President, and took an active interest in its prosperity, which was strengthened by his regard for his friend Professor Silliman—a man whom we all esteem for his zealous and successful exertions to advance the interests of Science, as well as for his extensive acquirements and his many virtues. On this occasion Mr. Maclure declared his intention to bring back with him from Mexico a number of young native Indians, in order to have them educated in the United States, and subsequently diffuse the benefits of instruction among the people of their own race. This benevolent

object, however, was not accomplished; for in the ordering of Providence he did not live to return.

From New Haven Mr. Maclure proceeded to New York, and embarked for Mexico. Time and distance, however, could not estrange him from that solicitude which he had long cherished for the advancement of education in his adopted country; and from his remote residence he kept a constant correspondence with his friends in the United States, among whom was the author of this memoir.

Mr. Say* died in 1834, at New Harmony; and Mr. Maclure was thus deprived of one of his oldest and firmest friends. The loss seemed for a time to render him wavering as to his future plans; but convinced, on reflection, that his educational projects in the West could be no longer fostered or sustained, he resolved to transfer his library at New Harmony to the Academy of Natural Sciences. This rich donation was announced to the Society in the autumn of 1835; and Dr. Charles Pickering, who had been for several years librarian of the institution, was deputed to superintend the conveyance of the books to Philadelphia; a trust which was speedily and safely accomplished.

This second library contained 2259 volumes, embracing, like the former one, works in every department of useful knowledge, but especially Natural History and the Fine Arts, together with an extensive series of maps and charts.

Mr. Maclure's liberality, however, was not confined to a single institution: the American Geological Society, established, as we have already mentioned, at New Haven,

* Mr. Say was one of the founders of the Academy; and among the last acts of life, he provided for the further utility of the institution by requesting that it should become the depository of his books and collections. This verbal bequest was happily confided to one whose feelings and pursuits were congenial to his own; and the Academy is indebted to Mr. and Mrs. Say for some of its most valuable acquisitions.

An interesting and eloquent Memoir of Mr. Say, was written by Dr. Benjamin Horner Coates, and published under the auspices of the Academy in 1835.

partook largely of his benefactions both in books and specimens; and in reference to these repeated contributions, Professor Silliman has expressed the following brief, but just and beautiful acknowledgment: "This gentleman's liberality to purposes of science and humanity has been too often and too munificently experienced in this country, to demand any eulogium from us. It is rare that affluence, liberality and the possession and love of science unite so signally in the same individual."*

Since the year 1826 the Academy had occupied an edifice in some respects well adapted to its objects; but the extent and value of the library, suggested to Mr. Maclure the necessity of a fire-proof building. In order to accomplish this object he first transferred to the Society a claim on an unsettled estate for the sum of five thousand dollars, which was followed in 1837 by a second donation of the same amount. Meanwhile, having matured the plan of the new Hall of the Academy, and having submitted his views to the members, he transmitted, in 1838, an additional subscription for ten thousand dollars.

Thus sustained by the splendid liberality of their venerable President, the Society proceeded without delay in the erection of the new Hall. The corner stone was laid at the corner of Broad and George streets, with due form, on the 25th of May 1839; on which occasion an appropriate Address was delivered by Professor Johnson. The edifice thus auspiciously begun, was conducted without delay to completion; so that the first meeting of the Society within its walls was held on the 7th day of February 1840.

Mr. Maclure had fervently desired and fully expected to revisit Philadelphia; but early in the year 1839 his constitution suffered several severe shocks of disease, and from that period age and its varied infirmities grew rapidly upon him.

* Amer. Jour. of Science, vol. iii, p. 362.

Under these circumstances he became more than ever solicitous to return to the United States, to enjoy again the companionship of his family and friends, and to end his days in that land which had witnessed alike his prosperity and his munificence.

He made repeated efforts to accomplish this last wish of his heart; and finally arranged with his friend Dr. Burrough, then United States Consul at Vera Cruz, to meet him at Jalapa with a *littera* and bearers, in order to conduct him to the sea-coast. Dr. Burrough faithfully performed his part of the engagement; but after waiting for some days at the appointed place of meeting, he received the melancholy intelligence that Mr. Maclure, after having left Mexico and accomplished a few leagues of his journey, was compelled by illness and consequent exhaustion to relinquish his journey.

Languid in body, and depressed and disappointed in mind, Mr. Maclure reluctantly retraced his steps; but being unable to reach the capital, he was cordially received into the country-house of his friend Valentine Gomez Farias, Ex-President of Mexico, where he received all the attentions which hospitality could dictate. His feeble frame was capable of but one subsequent effort, which enabled him to reach the village of San Angel; where, growing weaker and weaker, and sensible of the approach of death, he yielded to the common lot of humanity on the 23d day of March, 1840, in the seventy-seventh year of his age.

The death of Mr. Maclure was announced to the Academy on Tuesday evening, the 28th of April, on which occasion the following Resolutions were unanimously adopted:—

Resolved, That the Academy has learned with deep concern, the decease, at San Angel, near the city of Mexico, of their venerable and respected President and benefactor, William Maclure, Esq.

Resolved, That although his declining health induced him to reside for some years in a distant and more genial clime,

this Academy cherishes for Mr. Maclure the kindest personal recollections, and a grateful sense of his contributions to the cause of Science.

Resolved, That as the Pioneer of American Geology, the whole country owes to Mr. Maclure a debt of gratitude, and in his death will acknowledge the loss of one of the most efficient friends of Science and the Arts.

Resolved, That as the patron of men of science, even more than for his personal researches, Mr. Maclure deserves the lasting regard of mankind.

Resolved, That a member of the Academy be appointed to prepare and deliver a discourse commemorative of its lamented President.

Resolved, That the Corresponding Secretary be requested to communicate to the family of Mr. Maclure a copy of these Resolutions.

Mr. Maclure died before he had accomplished *all* his views in respect to this Institution; for, looking forward, as he did, to renewed personal intercourse with its members, he intended to inquire for himself into the most available modes of extending its usefulness. This, as we have seen, was denied him; but the spirit of Science which was inherent in him, has descended upon his brother and sister; and to these estimable and enlightened individuals, we owe the consummation of all that their brother had proposed in reference to the Academy, which will be hereafter enabled to devote its resources exclusively to the advancement of those objects for which it was founded.

Thus closed a life which had been devoted, with untiring energy and singular disinterestedness, to the attainment and diffusion of practical knowledge. No views of pecuniary advantage, or personal aggrandizement, entered into the motives by which he was governed. His educational plans, it is true, were repeatedly inoperative, not because he did too little, but because he expected more than could be

realized in the social institutions by which he was surrounded. He aimed at reforming mankind by diverting their attention from the mere pursuit of wealth and ambition, to the cultivation of the mind; and espousing the hypothesis of the possible "equality of education, property and power" among men, he laboured to counteract that love of superiority which appeared to him to cause half the miseries of our species. However fascinating these views are in theory, mankind are not yet prepared to reduce them to practice; and without entering into discussion in this place, we may venture to assert, that what Religion itself has not been able to accomplish, Philosophy will attempt in vain.

Mr. Maclure's character habitually expressed itself without dissimulation or disguise. Educated in the old world almost to the period of manhood, and inflexibly averse to many of its established institutions, he was prone to indulge the opposite extremes of opinion, and became impatient of those usages which appeared to him to fetter the reason and embarrass the genius of man; and while he rejoiced in the republican system of his adopted country, he aimed at an intellectual exaltation which, to common observation at least, seems incompatible with the wants and impulses of our nature.

Fully and justly imbued with the importance of disseminating practical truth, he strove through its influence to bring the several classes of mankind more on a level with each other; not by invading the privileges of the rich, but by educating the poor; thus enforcing the sentiment that "knowledge is power," and that he who possesses it will seldom be the dupe of designing and arbitrary minds. With a similar motive he endeavoured to inculcate the elements of Political Economy, by the publication of epistolary essays in a familiar style, which have been embodied in two volumes with the title of *Opinions on Various Subjects*. They discover a bold and original mind, and a fondness for innovation

which occasionally expresses itself in a startling sentiment; but however we may differ from him on various questions, it must be conceded that his views of financial operations were remarkably correct, inasmuch as he predicted the existing pecuniary embarrassments of this country, at the very time when the great mass of observers looked forward to accumulating wealth and unexampled prosperity.

Let it not be supposed that Mr. Maclure's benevolent efforts were restricted to those extended schemes of usefulness to which we have so often adverted. Far, very far from it. His individual and more private benefactions, were such as became his affluent resources, influenced by a generous spirit. He habitually extended his patronage to genius, and his cordial support to those plans which, in his view, were adapted to the common interests of humanity. There are few cabinets of Natural History in our country, public or private, that have not been augmented from his stores, and several scientific publications of an expensive character, have been sustained to completion by his instrumentality. While in Europe he purchased the copper-plate illustrations of some important works both in Science and Art, with the intention of having them republished at home in a cheaper form, in order to render them accessible to all classes of learners. Among these works was Michaux's Sylva, which is now going through the press in conformity to his wishes.

He was singularly mild and unostentatious in his manner; and though a man of strong feelings, he seldom allowed his temper to triumph over his judgment. Cautious in his intimacies, and firm in his friendships, time and circumstance in no degree weakened the affections of his earlier years. Though affable and communicative, Mr. Maclure was very much of an isolated man during the last thirty years of his life; partly owing to a naturally retiring disposition, partly to the peculiarity of some of his opinions, in respect to which

though unobtrusive, he was inflexible—but mainly to that frequent change of residence which is unfavourable to social fellowship. Hence it is that of the thousands who are familiar with his name in the annals of Science, comparatively few can speak of him from personal knowledge.

In person he was above the middle stature, and of a naturally robust frame. His constitution was elastic, and capable of much endurance of privation and fatigue, which he attributed chiefly to the undeviating simplicity of his diet. His head was large, his forehead high and expanded, his nose aquiline; and his collective features were expressive of that undisturbed serenity of mind which was a conspicuous trait of his character.

Those who knew him in early life, represent him to have been remarkable for personal endowments; a fact which is evident in the full-length portrait now in possession of his family, and which was painted upwards of forty years ago by the celebrated Northcote. The lithographed likeness which accompanies this memoir, is copied from a portrait taken by Mr. Sully in 1824, at which period Mr. Maclure was about sixty-three years of age.

Such was William Maclure, whose long, active and useful life is the subject of this brief and inadequate memorial. His remains are entombed in a distant land, and even there the spirit of affection is raising a tablet to his memory. But his greater and more enduring monument, is the edifice within whose walls we are now met to recount and perpetuate his virtues. Wherever we turn our eyes we behold the proofs of his talent, his zeal, his munificence. We see an Institution which, under his fostering care, has already attained the manhood of Science, and is destined to connect his name with those beautiful truths which formed the engrossing subject of his thoughts. We see around us the collections that were made with his own hands, vastly augmented, it is true, by the zeal of those who have been stimulated by his

example. Here are the books which he read—to him the fountains of pleasure and instruction. Here has he concentrated the works of Nature, the sources of knowledge, the incentives to study; and, actuated by his liberal spirit, we open our doors to all inquiring minds, and invite them to participate, with us, in these invaluable acquisitions; and while we regard them as a trust to be transmitted unblemished to posterity, let us honour the name and cherish the memory of the man from whom we derived them.

Death of Mr. Loudon.

On the 14th of Dec. 1843, died, at his house at Bayswater, John Claudius Loudon, Esq., who, for nearly half a century, has been before the public as a writer of numerous useful and popular works on gardening, agriculture, and architecture.

Mr. Loudon's father was a farmer, residing in the neighbourhood of Edinburgh, where he was very highly respected; but Mr. Loudon was born on April 8th, 1783, at Cambuslang, in Lanarkshire, where his mother's only sister resided, herself the mother of the Rev. Dr. Claudius Buchanan, afterwards celebrated for his philanthropic labours in India. Dr. Buchanan was several years older than Mr. Loudon, but there was a singular coincidence in many points of their history. The two sisters were, in both cases, left windows at an early age, with large families, which were brought up by the exertions of the eldest sons; and both mothers had the happiness of seeing their eldest sons become celebra-

Mr. Loudon was brought up as a landscape-gardener, and began to practise in 1803, when he came to England with numerous letters of introduction to some of the first landed proprietors in the kingdom. He afterwards took a large farm in Oxfordshire, where he resided in 1809. In the years 1813-14-15, he made the tour of Northern Europe, traversing Sweden, Russia, Poland, and Austria; in 1819 hestravelled through Italy; and in 1828 through France and Germany.

Mr. Loudon's career as an author began in 1803, when he was only twenty years old, and it continued with very little interruption during the space of forty years, being only concluded by his death. The first works he published were the following:—*Observations on laying out Public Squares*, in 1803, and on *Plantations*, in 1804; a *Treatise on Hothouses*, in 1805, and on *Country Residences*, in 1806, both 4to.; *Hints on the For-*

mation of Gardens, in 1812; and three works on *Hot-houses*, in 1817 and 1818. In 1822 appeared the first edition of the *Encyclopædia of Gardening;* a work remarkable for the immense mass of useful matter which it contained, and for the then unusual circumstance of a great quantity of woodcuts being mingled with the text: this book obtained an extraordinary sale, and fully established his fame as an author. Soon after was published an anonymous work, written either partly or entirely by Mr. Loudon, called the *Greenhouse Companion;* and shortly afterwards *Observations on laying out Farms*, in folio, with his name. In 1824, a second edition of the *Encyclopædia of Gardening* was published, with very great alterations and improvements; and the following year appeared the first edition of the *Encyclopædia of Agriculture*. In 1826, the *Gardener's Magazine* was commenced, being the first periodical ever devoted exclusively to horticultural subjects. The *Magazine of Natural History*, also the first of its kind, was begun in 1828. Mr. Loudon was now occupied in the preparation of the *Encyclopædia of Plants*, which was published early in 1829, and was speedily followed by the *Hortus Britannicus*. In 1830, a second and nearly re-written edition of the *Encyclopædia of Agriculture* was published, and this was followed by an entirely re-written edition of the *Encyclopædia of Gardening*, in 1831; and the *Encyclopædia of Cottage, Farm, and Villa Architecture*, the first he published on his own account, in 1832. This last work was one of the most successful, because it was one of the most useful, he ever wrote, and it is likely long to continue a standard book on the subjects of which it treats. Mr. Loudon now began to prepare his great and ruinous work, the *Arboretum Britannicum*, the anxieties attendant on which were, undoubtedly, the primary cause of that decay of constitution which terminated in his death. This was not, however, completed till 1838, and in the mean time he began the *Architectural Magazine*, the first periodical devoted exclusively to architecture. The labour he underwent at this time was almost incredible. He had four periodicals, viz. the *Gardener's*, *Natural History*, and *Architectural Magazines*, and the *Arboretum Britannicum*, which was published in monthly numbers, going on at the same time; and, to produce these at the proper times, he literally worked night and day. Immediately on the conclusion of the *Arboretum Britannicum*, he began the *Suburban Gardener*, which was also published in 1838, as was the *Hortus Lignosus Londinensis*; and in 1839 appeared his edition of Repton's *Landscape-Gardening*. In 1840, he accepted the editorship of the *Gardener's Gazette*, which he retained till November, 1841; and in 1842 he published his *Encyclopædia of Trees and Shrubs*. In the same year he completed his *Suburban Horticulturist;*

and finally, in 1843, he published his work on *Cemeteries*, the last separate work he ever wrote. In this list, many minor productions of Mr. Loudon's pen have necessarily been omitted; but it may be mentioned, that he contributed to the *Encyclopædia Britannica* and Brande's *Dictionary of Science;* and that he published numerous supplements, from time to time, to his various works.

No man, perhaps, has ever written so much, under such adverse circumstances as Mr. Loudon. Many years ago, when he came first to England (in 1803), he had a severe attack of inflammatory rheumatism, which disabled him for two years, and ended in an anchylosed knee and a contracted left arm. In the year 1820, whilst compiling the *Encyclopædia of Gardening*, he had another severe attack of rheumatism; and the following year, being recommended to go to Brighton to get shampooed in Mahommed's Baths, his right arm was there broken near the shoulder, and it never properly united. Notwithstanding this, he continued to write with his right hand till 1825, when the arm was broken a second time, and he was then obliged to have it amputated; but not before a general breaking up of the frame had commenced, and the thumb and two fingers of the left hand had been rendered useless. He afterwards suffered frequently from ill health, till his constitution was finally undermined by the anxiety attending on that most costly and laborious of all his works, the *Arboretum Britannicum*, which has unfortunately not yet paid itself. He died at last of disease of the lungs, after suffering severely about three months; and he retained all the clearness and energy of his mind to the last.

His labours as a landscape-gardener are too numerous to be detailed here, but that which he always considered as the most important, was the laying out of the Arboretum so nobly presented by Joseph Strutt, Esq., to the town of Derby.

Never, perhaps, did any man possess more energy and determination than Mr. Loudon; whatever he began he pursued with enthusiasm, and carried out, notwithstanding obstacles that would have discouraged any ordinary person. He was a warm friend, and most kind and affectionate in all his relations of son, husband, father, and brother; and he never hesitated to sacrifice pecuniary considerations to what he considered his duty. That he was always most anxious to promote the welfare of gardeners, the volumes of this Magazine bear ample witness; and he laboured not only to improve their professional knowledge, and to increase their temporal comforts, but to raise their moral and intellectual character.

Observations on Organic Chemistry and its relations to Physiology. By JUSTUS LIEBIG, M.D., PH.D.

[Professor Liebig has requested us to state that his remarks upon physiologists and pathologists in this paper are intended to apply to those of Germany, and not to the physiologists and pathologists of this country. The criticisms upon his works which have appeared in England, at least such of them as have reached him, do not appear to require any animadversions on his part. But since the reviews of Schulz, Henle, and others have been recently reprinted in the English journals, Professor Liebig has thought proper to republish his answer to them in THE LANCET, in order to enable the English readers of those articles to form a just opinion of their true value. If there be any passage in Professor Liebig's reply not very agreeable to the taste of his adversaries, they must remember that there has been much in their attacks not very palatable to him, and, moreover, that he was not the aggressor, but he was compelled, in the interest of science, to stand upon his own defence.] *Lancet, Jan.* 1844.

The appearance of my work on "Chemistry, in its applications to Agriculture and Physiology," gave rise to criticisms from men from whom I should rather have expected aid in my endeavours to advance the science, than opposition, characterised by intemperance and passion, rather than by candour and that liberal spirit which ought to guide us in our judgment on the labours of others. Many of these attacks were directed against persons whose friendship I value most highly, rather than against myself personally, or my book, and I, therefore, felt it my duty to defend my views, and to refute the objections advanced, in the manner they deserved. It was a different matter with respect to the objections made, and the difficulties involved in my statements, pointed out by Schleiden and Mohl; in them, under rather a repulsive husk, I could discern the true kernel of the love of science; I have, therefore, not replied to their writings, because instead of entering with them upon a mere war of words, I hoped to reconcile these gentlemen by my actions, convinced that we should at lengh agree. Those parts of my works which were opposed to their better experience, and which they particularly objected to, I have altogether left out of my 5th edition (3d English); other points, concerning the correctness of which I was too well assured to doubt, from any assertion of theirs, I retained, although these also might have been omitted without affecting the real value of the work.

The corrections which their remarks suggested were apart from the main purpose of my labours; and I have nothing to regret, save that the difference in the direction of our inquiries has deprived me of an opportunity of expressing how highly I appreciate the results of their great and comprehensive labours in vegetable physiology. In such honest and energetic endeavours as theirs for the advancement of science, there is so much devotedness and self-sacrifice, that even the merited approbation of an individual, although of no great value in comparison with the appreciation of the public, may, nevertheless, not be altogether unwelcome.

The publication of my "Animal Chemistry" placed me in the same awkward position with many physiologists. Schulz, Henle, and others appear to derive gratification in detaching sentences of my writings from their connection, and making them the object of severe criticism, by which the true relation of chemistry to physiology were made much more manifest to me than before. Such mistakes, either involuntary or intentional, I could not have supposed possible. I had really thought that the ordinary studies of the physiologist and the physician would enable them to form, at least, some judgment respecting the questions which I discussed. But from the attacks and objections which were made to my views I could immediately perceive that they emanated from persons who had never occupied themselves with physics or chemistry, and who were altogether unacquainted with the principles and true spirit of these sciences. This induced me to make very light of such opposition; I could confidently leave the decision to the future.

The ranks of my opponents, however, have been strengthened by the accession of an individual upon whose approbation and applause I was accustomed to reckon for many years, and who, by his great experience and labours, has acquired a well-founded right to pronounce a judgment upon questions connected with these sciences.

Immediately after the appearance of my first work on Agricultural Chemistry, Berzelius communicated to me, by letter, many objections to my views, and declared to me openly, and without reserve, how little his own experience agreed with my observations. These objections induced me to submit all the points at issue between us again to the test of a strict and minute examination, the results of which only tended to strengthen my conviction of the truth of my first impressions, and determined me to persevere in the direction I had taken.

I thought I had succeeded in removing all his doubts in the course of our correspondence, and I, therefore, was very much astonished to find all his objections re-appear in his "Twenty-first Annual Report of the

Progress of Chemistry." This proceeding was continued in his subsequent Annual Reports, and appeared at length so completely at variance with his former principles that I thought it my duty to call his attention to its injustice. I desired him to consider that our long standing and intimate friendship forbade me to repel his attacks in the manner they deserved, and that I therefore stood defenceless.

All this was unavailing; there was a chasm between us which no longer admitted of being filled up, and it is only after having suffered the most insulting and injurious attacks, that I perceive (to quote Berzelius's own words) "that it would be a misfortune to science to permit its interests to be set aside for friendship's sake." (Ann. Rep., 23, p. 576.)

In the Twenty-third Annual Report, Berzelius lays aside all moderation, and the same hostile disposition towards me is manifested in the new edition of his Manual; and he has been induced to express opinions upon my labours in inorganic chemistry which are totally unfounded and inexcusable.

Under these circumstances nothing remains for me save to expose, in all simplicity and candour, the relation in which Berzelius stands to the present state of organic chemistry. And when, in this exposition, I speak of physiologists and pathologists, and the bearings of chemistry on physiology, I must remind my readers that I allude to individuals, or to their intellectual tendencies, whose names I do not mention, because ere long they will cease to have any interest in connection with the matter, and, in fact, they do not at all belong to the subject in dispute.

During the last four years, since Berzelius has ceased to take any part in experimental investigations of the questions now arising in the science, his whole mental powers have been directed to theoretical speculations. But unsupported by his own experiments, his views have found no response in science. As long as he pursued experiments, and confined his inferences to them, the results he obtained were safe and trust-worthy guides in the field of science, but a new domain, foreign to him, has since been cultivated with success; phenomena have been observed, contradictory to views formerly held, and inexplicable upon principles derived from the acquisitions of science at that time. This has led to new modes of explaining the phenomena observed, irresistible to all those who have been themselves experimentally engaged in their investigation; and it is the contest of the former with the latter,—the necessary consequences of the progress of the science,—upon which Berzelius has entered in the spirit of a partisan, a contest the final

result of which it is not difficult to foresee. When Berzelius first entered upon his career many hypotheses prevailed which he did not hesitate to combat in the interest of science; he went further, and history shows with what success he substituted, by his indefatigable investigations, better theories in their place. It is in the very nature of science that many of his views should meet with the same fate; more correct theories, notions nearer to truth, must at length replace them, and it is thus only that the truth, which is the aim and object of our researches, will at length be attained.

To combat these more modern views with reasons derived from observations made long since, and without deigning to enter anew upon personal investigations as to their truth, has been the way taken by Berzelius of late, a way which obviously cannot lead him to his object.

Every author of a long and laborious investigation has an undoubted right to draw his own inferences as to the nature and composition of the bodies he discovers, to assign to them a name, and to express them by formulæ, what part has Berzelius taken in these investigations? Has he shown the incorrectness of these formulæ by new experiments? Has he proved the fallacy of the inferences and conclusions by placing them in opposition to the results of his own experience? Nothing of the kind. Why, and for what reason, then, does he alter the formulæ of the chloric ether compounds of Malaguti, of the napthaline compounds of Laurent, of the benzoyl compounds, and the products of uric acid, with an arbitrariness hitherto unexampled? Why does he admit into the composition of these substances compounds which either do not at all exist, or to say the least, the existence of which is very doubtful? Has not his fixing the formulæ of cerebrote, cephalote, stearoconote, the formation of piotic, hypopiotic, and piotinigic acids, shown how little was gained thereby, and to what errors want of personal experience in this department led him.

None of those chemists whose labours Berzelius thought were thus improved adopted his views, and therefore an irreparable breach could not fail to ensue between them. Never, under any circumstances, would Berzelius have endured this kind of tyranny from others; he would have repudiated it with all his might; and that this has not yet been done to him by other chemists arises simply from the high esteem in which he is held for his immeasurable labours.

Abandoning himself to this course, which would, in former times, have been so utterly repugnant to him, he constructed, from an isolated instance of the atomic theory, "that equal constitution does not necessarily produce equal properties," the special theory of isomeric substances, and this led him to the invention of the *catalytic force.*

The power of platinum to facilitate the combination of gaseous substances,—that of yeast to resolve sugar into alcohol and carbonic acid,—that of sulphuric acid to resolve alcohol into ether and water,—differ from the ordinary phenomena of affinity, as those, for instance, which accompany the combustion of charcoal in oxygen gas, or the combination of sulphuric acid with potass. They were, at that time at least, or, according to the notions of Berzelius, inexplicable phenomena. Now, how did he facilitate our inquiries into these phenomena? Against all the rules of rational inquiry, against all logic, he considered these properties of sulphuric acid, of platinum, and of yeast, not as the effects of different causes, which was apparent to every one else, in such various substances, but ascribed all these different effects to one and the same cause, and this a new and unknown cause. He indeed, admits it to be unknown, but he treats it, in discussing unexplained phenomena, as a force with the properties of which we are perfectly acquainted.

If any one will take the trouble to place in the following passages, quoted from Berzelius, instead of the words *catalytic fosce*, the true meaning of the words, namely, *the unknown cause of phenomena not further investigated*, it will be seen how little has been gained by the assumption of the *catalytic force*. It will, also, at once be evident that with its admission all further inquiry into the true causes will be at an end.

To us it appeared, from the very outset, to be nothing better than *phlogiston* resuscitated.

"If, with this idea, we turn to the chemical processes in living nature, a new light breaks in upon us. When nature has placed diastate in the eyes of potatoes, this leads us to the way in which the insoluble starch becomes converted by the catalytic force into gum and sugar; but it does not follow therefrom that this catalytic process is the only one in vegetable life; we on the contrary, are led to assume that in living plants and animals thousands of catalytic processes take place between the tissues and the fluids."—Berzelius, 15th Annual Report, p. 244.

"Mitscherlich has shown that the catalytic force of sulphuric acid becomes increased by concentration and elevation of temperature."—15th Ann. Rep., p. 352.

"Since a catalytic operation by contact is admitted (and this is at present an undoubted fact), it is impossible to say where it does *not* take place in chemical processes."—20th Ann. Rep., p. 455.

Certainly no one could consider it a crime in me that I did not deem these views admissible, and that, following my own conviction, I declared it to be a mistake to make our symbolic language an expression for

changeable theoretical notions,—for the theory of volumes, for instance. And when instead of the obscure notion concerning the saturating power of the acids which then prevailed, I endeavoured to give a better one, according to my own apprehensions, and when I attempted to apply an indisputable axiom of mechanics to the phenomena of combination and decomposition, in what respect did I justly incur reproach? Upon phenomena imperfectly studied before I commenced, and upon new observations, I have based and established the theory of putrefaction and decay; I have shown that humus cannot be the source of the carbon of vegetables; I have, in the course of my investigations into the transformations which nitrogenous substances undergo in the presence of water and air, found ammonia to be the ultimate and only source of nitrogen in plants; and I have determined the necessity of the alkalies, the alkaline earths, and the phosphates, to vegetable life, which was so long disregarded by chemists and mistaken by physiologists.

What connection is there between these views, which are opposed to those of Berzelius, and my other labours? Why does my method of purifying antimony no longer, according to his account, yield antimony free from arsenic? Why is my method of preparing cyanide of potassium fraught with difficulties now, and no longer to be considered an improvement? Why does my separation of nickel from cobalt now exist only upon paper? Why does Berzilius incessantly warn us, in physiological investigations, not to go beyond his labours of thirty years since? Shall we then continue to consider blood corpuscules as *globulin*, and *caseine* as soluble in water?—albumen as an acid and a base? Or to assume a dozen substances as constituents of the *bile*, when our investigations have proved these things to be otherwise?

Shall we continue to bruise the liver and kidneys in a mortar in order to obtain a knowledge of their composition and vital functions? Of what avail have all these labours proved to physiology? Their results drag heavily along, in the MANUALS, a cumbrous and useless burthen; they introduced totally fallacious methods of investigation into chemical physiology, and created that aversion and nausea with which physiologists have regarded chemistry. What light could such investigations, made after the example of Fourcroy and Vauquelin, throw upon the mysterious processes of organic life? What advantage could possibly be derived from all these figures which were unconnected with questions of fact, from investigations made without any definite object, and conducted without method? Whilst, with the analysis of a silicate, the ultimate problem of the analyst was solved, the mere production of the animal constituents, and their analysis must be considered only as the

beginning of the task of the chemist. I felt it right to reject all such results, and to urge incessantly upon chemists that figures are of no use whatever unless connected with definite questions; that these methods could prove of no avail to physiology; and that our labours, to be of any value, must be available as preparatory to those of physiologists.

I had an undoubted right to do this, as much as a man who perceives his fellow-travellers are pursuing a wrong road has to warn them to retrace their steps, more especially as one who has devoted his life to the improvement of this department of science. Must I remind Berzelius what has been done during the last twenty years in the chemical school at Giessen? He has been living all this time, and ought not to forget it so easily, even should it be forgotten by a younger generation.

I fear not to speak of my own labours, from hippuric acid to my recent investigation of urine, nor to mention those which I have made in common with Wöhler. I must remind Berzelius that, from the very outset of my career, all my efforts have been directed to the attainment of a definite object. I feel almost ashamed to recall to Berzelius' mind how much has sprung from my endeavours, and to remind him of the advantages that have been derived from my methods, and from the introduction and adoption of my apparatus. But I may be allowed to quote a passage from a paper on some nitrogen compounds, published ten years ago (Annalen der Chemie and Pharm., Bd. x., s. 3), since this will tend to render my object and purpose more clear and intelligible to him and also to my readers.

"Our insight into the mysterious processes of the animal organism will acquire a very different import if, instead of resting satisfied with decomposing the substances occurring in the various organs, into numerous other combinations, the properties of which teach us nothing, we follow their alterations and transformations, step by step, through elementary analysis, without heeding (for the moment) their properties; whilst in this manner, we arrive from one link to the other, we indubitably approach the point more and more from which the chain proceeds; infinitely distant though this point may be, yet we approach it.

"We know that the oxygen of the atmosphere stands in a definite relation to the blood in the respiratory process; we can show the alterations which the air undergoes, and observe the phenomena taking place in the lungs; but if the science of chemistry does not succeed in following up in the animal body all the alterations which take place in the organs, and in the substances acting upon the organs, and operated upon by them in return, and in obtaining an insight into these alterations, it is not worth while to occupy ourselves with them. So

much I consider as certain, that the way which has been hitherto pursued fritters away our energies without producing any real advantage."

If this expression of my sentiments at that time be compared with my former or subsequent labours, and be taken in connection with the mass of valuable investigations, conducted by talented and skilful young chemists, at my instigation and under my observation,—investigations which embrace every constituent of the animal and vegetable kindoms, and form a great part of all we know thereof—every one, whether favourable or opposed to my views, will confess that all these labours have a common centre—that they are links of one and the same chain. The labours of Demarcay, on the nature of bile; the important investigations of fatty substances by Redtenbacher, Bromeis, Varentrapp, Meyer; of the constituents of blood and milk, by Jul. Vogel, Scherer, Jones, Rochleder, and of so many others,—what purpose can reasonably be assigned to them, except the practical confirmation of those principles upon which I proceeded at the very outset of my career, and which I developed ten years ago in the clearest manner possible, and to which I adhere now with the same conviction as formerly.

If my object had not been the attainment of truth, but merely the acquisition of some specious and futile arguments, I might, with regard to the investigation of the nature and constitution of bile, have rested satisfied with Demarcay's figures; but I subsequently induced Kemp to undertake the same investigation, and after him Theyer and Schloser. These latter gentlemen, after a laborious investigation, which lasted for years, arrived at last at a knowledge of the true nature and constitution of bile, and were enabled to prove that the composition of the bile is not perpetually changing, as was previously supposed, and therefore that the gall-bladder is not like a common sewer, into which all the waste matters of the body indiscriminately flow. In this manner every individual fact was treated, and all its points fully ascertained and determined.

And now, after eighteen years of incessant labour, and after the application of the intellectual energies of so many individuals, when I venture to sum up our results, and to deduce such inferences and conclusions as legitimately flow from them, there comes a man—my friend—of the highest authority in science, and dares to brand the intellectual expression of all these labours as a mere play of fancy! He calls our results "probability-theories," and this simply, and for no better reason, than because we take the heart for a pressure and suction-pump, in the sense as the eye, for instance, is compared to a camera obscura,—because, by a mere error of the press, it is stated in my work, in one single place, that the urine is secreted from venous blood,—because we believe arte-

rial blood passes through the kidneys and venous blood through the liver, and all this proves to him that the author has not sufficiently studied the principles of the science upon which he writes.*

Even admitting that these views are grossly erroneous, was their establishment the object of the author's labours? When he endeavoured to ascertain the composition of bile, of urea, of uric acid, of blood, and the organic tissues, and to discover their relations to the aliments and secretions, was it not perfectly indifferent, as far as his immediate object was concerned, whether the urine is secreted from venous or from arterial blood? and whether the heart is a force and suction-pump, or not?

When the chemist maintains that the blood is not formed from starch and sugar; that the bile is not to be found in the fæces, but is eliminated from the organism in a gaseous form; when he develops his theories that those remedies, which are products of organic life, take a share in the processes in the animal organism, similar to that which we positively know is taken by all the vegetable nutritive matters; when he further asserts that uric acid and urea are products of the transmutation of matter, and are not directly derived from the aliments; when he points out a close connection between nutriment, loss of heat, and consumption of energy; ought all these assertions, after the labours which have preceded them, and whereon they are founded, to be styled "probability-theories," "fantastic notions?" must all the investigations made during the last thirty years be deemed to have produced no result whatever capable of any useful application?

Must I, then, remind my opponents what notions prevailed, even so late as four years ago, on the nutrition of plants? Must I remind them of the fact, that the result of the last investigations of Boussingault, with regard to the advantages of the rotation of crops, consisted in his ascribing them to the destruction of weeds, and that the cereals receive their nitrogen from the manure, whilst the leguminous plants derive part of it from the atmosphere? How many proofs of the correctness of the principles laid down by me, could I not place in Berzelius' hands, obtained from the most intelligent, the most clear-headed farmers of England and Germany, who have had occasion to test and verify their correctness, in a simpler and safer method of cultivation—an infinite

* "Thus we have seen it stated in chemico-physiological works that the heart is a pressure as well as a suction-pump; that the urine is secreted from venous blood; that arterial blood, before it returns to the lungs, passes through the kidneys, whilst venous blood passes through the liver, &c. This proves sufficiently that the author had not thoroughly studied the principles of the science on which he wrote."—(Berzelius, Twenty-third Annual Report, p. 573.)

saving of labour and money, and in the more abundant crops of their fields.

Had a physician, who began his studies forty years ago, and who has not followed during all this time the discoveries made and the experience attained, started these objections, I should not have stooped to notice it. But do the analyses of fæces and urine, the first contributions to physiology which Berzelius made,—contributions which give us about as much information on the origin of fæces and urine as we might have derived from an analysis of garnet,—do these give Berzelius a right to style the results of our labours "probability-theories," because we connect other questions with them, and endeavour to derive from them certain useful applications.

I fully, and with pleasure, acknowledge the value which his invariably exact and conscientious labours have had in their time, and which they still possess, since they prepared the way for our present knowledge, and since without them *we* should have been obliged to go through the same laborious investigations. But is it impossible to over-estimate the labours of Berzelius? Is the field of scientific inquiry to be limited by the results of his investigations? Far from it. No such dominion as that exercised by Aristotle can now be conceded to any man. Nature still offers illimitable mines for us to explore, and shall he whose labours are rewarded with great discoveries feel no enthusiasm and express no gratification at his success?

For my own part, I confess that I felt my whole nervous system thrilling, as if pervaded by an electric current, when Wöhler and myself discovered that *uric acid* and all its products, by a simple supply of oxygen, became resolved into *carbonic acid* and *urea*, thus showing that there existed a connection between urea and uric acid, such as had never before been dreamed of, in its infinite simplicity,—when our calculation proved that *allantoin*, the nitrogenous constituent of the urine of the fœtus of the cow, contains the elements of uric acid and urea, and when we succeeded in producing allantoin, with all its properties, from uric acid. Though few words passed between us whilst engaged in these investigations, how often have I seen the eyes of my friend glistening with delight! I felt the same thrilling sensation when, during my investigation of Melam, and whilst following up the ultimate products of cyanogen,—the most simple of all organic radicals,—I found that the atoms, instead of resolving themselves into more and more simple atoms, and finally into elementary atoms, re-arranged themselves into far more complex groups than cyanogen; and when, upon investigating the sulphureous and nitrogenous constituents of plants, I found

with every new analysis my presentiment realised that they are all identical in constitution with the blood. All these facts spoke to me in a language which I believe I rightly understood, for I had taken the greatest pains fully to comprehend the exact meaning and signification of the words: ought I, then, to be censured for venturing upon the attempt to render their meaning as clear and intelligible to others,—to communicate to others the ideas these words seemed to convey to me?

The most difficult part of my task unquestionably was, that I had to address a public unskilled and inexperienced in the language of the phenomena; the physiologists and pathologists to whose pursuits my labours appertained did not understand the method of interpretation familiar to chemists, nor did they even know the meaning of the individual words. Thus, the Englishman who is but imperfectly acquainted with German, reproaches even our best translations of Shakspeare, with weakness, want of life and vigour, as compared with the original; thus, too, the German who reads for the first time a French translation of one of Schiller's poems, finds the version feeble and unmeaning; now, the real reason of this is, that those who judge thus, are ignorant of the real meaning and import of the words used in the foreign version, ignorant of what constitutes exactly equivalent expressions in both languages. A good French version of Schiller produes the same effect upon the mind of a Frenchman as the original does upon that of a German. To be able to judge what difference from the original may really be laid to the charge of the translator, a very correct and perfect knowledge of both languages is indispensable.

This is the relation in which many physiologists stand to the chemist, with regard to the consideration and solution of physiological questions. Everything which the chemist considers as unquestionable premises whence he may safely deduce conclusions appears weak and doubtful to the physiologist.

Their own inability to understand and appreciate the value of the reasons advanced, makes them believe that these reasons constitute a defective proof. Chemistry cannot be of any use to such persons in their inquiries,—from a fear of being unscientific they sacrifice the true logic of science,—the highest scientific theories become to them the grossest nonsense.

It is far easier to come to an understanding with the strictest mathematician than with such physiologists. The mathematician is kind enough to permit us to infer from two known quantities a third, or from three known quantities a fourth unknown one; the physiologist can permit nothing of the sort.

When the chemist places a calculation before the physiologist the latter asks him for his proofs; he is not satisfied with these, but he requires him to *prove* these proofs, and then to prove the proofs of the proofs! The chemist says, "I know the weight of a certain amount of tobacco, and the weight of the ashes remaining upon its incineration; I know also, therefore, the amount of what has gone off in the smoke." "Prove it!" exclaims the physiologist. If the chemist had weighed the smoke, disregarding altogether the weight of the tobacco and of the ashes, the physiologist would have considered the result far more correct, so strangely perverted are some people's intellects.

The Grand Duke of Hesse provides his soldiers with two pounds of bread *per diem*; the King of Prussia and the Emperor of Austria provide their soldiers with the same amount. Now, soldiers do not live upon bread alone, they partake of other aliments besides, and of all these aliments there remains nothing in the economy, nothing is permanent in the organism, except the bones. With military scrupulousness the sergeant major weighs all their other aliments down to pepper, salt, and vinegar; all these aliments, bread included, are examined as to their amount of carbon; the quantity of the fæces evacuated is determined, and so is the amount of carbon they contain. Thus we know the amount of carbon supplied by the aliments as well as of that eliminated by the fæces. Now, it has been positively ascertained that the carbon which enters the organism through the mouth has, besides the fæces, no other channel or exit except in the urine, and through the skin and the lungs; and, moreover, that the carbon is eliminated, in the form of carbonic acid, by the skin and the lungs; and that urea and water mean nothing else than carbonic acid and ammonia. We may, therefore, by a very simple calculation, deduce the unknown quantity from the two known quantities, and assert that an adult healthy individual, who is drilled during four hours every day, and has, at the same time, to carry a heavy burthen, burns in his organism about thirteen ounces and a half of carbon *per diem*.

This conclusion is as true as the assertion of the mechanician who, by the experiments made on a body of 100,000 soldiers, has ascertained that, on an average, a healthy full-grown man cannot carry above thirty pounds for eight hours consecutively without injury to his health. The statistician does not proceed upon the principle of the physiologist, who considers this conclusion erroneous because, forsooth, some feeble individual is not able to carry more than ten pounds, or because strong person, whom he knows, can carry fifty or a hundred

Thus it has been ascertained that the average duration of human life is thirty and some years, and yet it is precisely at the age of thirty that the smallest proportion of individuals die. All these figures come as near to truth as it is possible to arrive; they are, therefore, considered as *really* and *exactly* correct, and serve as the basis of calculation for the terms of tontines and life-assurances, or for fixing the weight of the arms and baggage a soldier may bear.

The *strictly* scientific physiologist is not satisfied with this; observations taken from nature on this scale do not convince him. Regardless whether an individual or an animal has partaken previously of a repast or not, without troubling himself whether with a full or an empty stomach, he shuts him up in a cage and determines the amount of oxygen which he inhales, and the quantity of carbonic acid which he exhales. Instead of weighing the tobacco and its ashes, he weighs the smoke! as if the sources of error were not a thousand times more obvious and considerable in this method than in the former! But supposing even this determination were exactly correct, what information does it afford him? Neither more nor less than the amount of what an individual, shut up in such a cage, inhales and exhales under certain circumstances, not very minutely examined, and which do not, at any rate, correspond with the normal state. But it does not inform him how much carbon this individual consumes in twenty-fours hours. If the experimentalist had given a bottle of good wine to the individual in the cage, or if the latter had taken a copious draught of cod-liver oil previously to entering into the cage, very different proportions would undoubtedly have resulted.

One of my friends has, for 212 days, taken two ounces of cod-liver oil *per diem*, or a sum total of thirty-five pounds and a quarter, during that period, without increasing in weight; his fæces, upon examination, have been found to contain no trace of the oil. Now, if from this we infer that these thirty-five pounds and a quarter have been eliminated by the skin and the lungs, having served for the support of the respiratory process, what can be rationally objected to such a conclusion? This individual, from the moment he began to take liver-oil, could no longer drink wine, precisely because both these substances mutually prevent their elimination in the normal way, that is, in the form of oxygen compounds. But still the physiologist is unsatisfied, and repeats his "Prove it!" When I show him that the amount of carbon which a full-grown individual, in a state of free motion and labour, consumes, accounts sufficiently for the evolution of heat in his organism, he replies, "This proves nothing, for we do not even know what heat is;

we can produce heat by rubbing together two pieces of wood, or of metal; there may be unknown sources of heat in the organism." As if I had intended to prove the nature of heat! or as if it were worth while to enquire for unknown causes when the known ones give us a satisfactory and perfect explanation! What are unknown causes but the offspring of the imagination, the issue and manifestation of weakness, when the real causes of phenomena lie beyond the sphere of our apprehension. —

Is the animal body a piece of wood or of metal, and can the same cause which produces heat by friction exist in the organism? And is it not altogether apart from the question to mix up the production of electricity in fishes with the enquiry into the production of animal heat? The natural philosopher knows, with positive certainty, that the electric currents in fishes are not the cause of their temperature; *if they were so, these animals would not be able to produce electric effects.*

When Volta constructed his admirable pile, he thought he had succeeded in making his apparatus similar in all points to the organs upon the existence of which, in the gymnotus and torpedo, the power of these animals to produce electricity depends. Is it in accordance with the logic of science to consider electricity to be the cause of phenomena and effects in organisms where no such apparatus can be found? When we have positively, and beyond the admission of a doubt, ascertained that nature herself, in order to produce electric currents, employs apparatus precisely similar to those which the philosopher employs for the same purpose, is it possible to deduce any other conclusion from this fact than that wherever we perceive electric effects in the organism they originate in the same manner as the electric current in the battery?

All the objections against my views which have hitherto come to my knowledge are precisely similar in their character to this reference of all the phenomena of heat to electricity. Berzelius says (23rd Annual Report, page 383),—"When, in consequence of a violent mental emotion, the feet of an individual acquires a temperature far *below* the normal temperature, while the forehead of the person thus affected feels heated far *beyond* the normal temperature, must it not be obvious to any reflecting mind that the mutual action between the constituents of the aliments and oxygen *cannot be said here to be the cause that the evolution of heat increases in one place and diminishes in another.*"

What can be said to such an objection as this, except that Berzelius has not understood what I intended to prove; that he has altogether nceived my object?

I can determine, with the most positive certainty, the amount of alcohol necessary to heat a given amount of water or of iron and to maintain it at this temperature for a certain definite time; now, if in a stove or furnace altogether inaccessible to me, but provided with an aperture for the reception of the fuel, and another for the exit of the products formed by the combustion of this fuel, I find that these products consist of carbonic acid, water, and ammonia, and that the conversion of the fuel into these compounds depends upon a constant supply of atmospheric oxygen, can I rationally and logically ascribe the higher temperature which I perceive in this stove or furnace to any other cause than that which I see producing the same effect in an accessible furnace? Are my conclusions to be deemed fallacious because they do not explain the manner in which heat propagates itself in the water, or in the iron, or in the inaccessible stove, *i. e.*, in the organism? I never intended to explain from what cause, or in what manner, the head becomes heated when the feet grow cold, although it is quite in accordance with my views that heat should accumulate in one place when its diffusion in other parts is impeded.

I know an individual whose head grows cold as ice when his mind is affected by any strong emotion, while his feet, at the same time, become glowing hot, but I do not think myself justified on that account to place the seat of the evolution of heat in the lower extremities.*

Questions relating to the distribution of heat in the animal body, and innumerable others relative to the processes and actions of the constituent parts of living organisms, we may properly anticipate will be answered hereafter—time only is required for the solution of many unsolved problems. What is chiefly needed at present is the determination of principles, the settlement of methods for the pursuit of investigations. So long as physiologists and pathologists (the latter are the more

* Thus I read in a work on physiology, published some time ago, a very insulting commentary on the following sentence in my "Chemistry applied to Physiolgy and Pathology:"—"The *only* known and *ultimate* cause of the vital activity in the animal organism is a chemical process." The words *only* and *ultimate* were in *italics*, as they are here, but the preceding and succeeding sentences were altogether omitted. The former sentence says,—"We recognise in the animal organism only one cause as the ultimate cause of all production of energy, and this is the mutual action which the constituents of the aliments and the oxygen of the air exercise upon each other." The succeeding sentence continues,—"If we exclude the chemical process, that is, the air and water, in the germination of seeds, or the air in the respiration of animals, the manifestations of life take place no longer, or they cease to be perceptible." What I intended to say here must be obvious to every one; I might indeed, have underlined the word *known*, and might perhaps, have substituted condition for cause. But who would have thought, after reading my book through, that any one could be in doubt with regard to my views respecting the cause of the vital phenomena?

chargeable with the error) refuse to adopt the methods of physics and chemistry—methods which have been pursued with such signal success in these sciences—so long as they are unable to discriminate between useful and useless experiments, and rest satisfied with the weighing of smoke, it is impossible that they should make any real progress.

Why do these physiologists and pathologists reject our science? By abandoning the Aristotlean method, that of the phlogiston theorists, namely, converting effects into causes, Chemistry has, during the last fifty years, progressed with gigantic strides towards comprehending all the natural phenomena within its domain. This science is at present in a rapid course of development, especially in its organic department; it is endeavouring to advance from the simple facts already ascertained —its known data—to the investigation and apprehension of the more complex and more intricate phenomena which still remain mysteries to us. It has already made us familiar with the effects and actions of *forces* upon all the inorganic matters in nature, and it is now employed in seeking to ascertain and define the exact share which those forces take in the vital processes, the limit of their sway in the living organism, and thus to distinguish and separate the chemical actions from the operations of the ultimate cause of *vital phenomena*—from the effects of *life* itself.

Chemistry, in its bearings upon, and application to medicine and physiology, may be considered as a microscope, adapted to facilitate observations and investigations into the mysteries of nature, and to render the phenomena observed more intelligible to the intellectual eye, and more susceptible of useful applications.

To comprehend the living organism entirely and satisfactorily we must be acquainted with everything occurring within it. But how can we read and understand a book if we are acquainted with only half the letters of the language in which it is written, and but few of the rules by which the construction of the language is governed. The letters and the rules necessary to be known for the comprehension of this volume of nature have been the object of the most laborious researches of the most sagacious and best experienced men for a thousand years. These researches have proved unavailing, the end is not yet attained, because a wrong road was taken, and the means employed were not adapted to the object in view. A right direction, correct means, judicious and well considered methods, were formerly altogether wanting.

Medicine and physiology are, like other sciences, in a continual state of progress; enormous labours, the expenditure of incalculable energies, have elevated these sciences to that high degree of development which they have attained, to the exalted ground they now occupy.

The questions upon which everything at present hinges are these: Are the methods of inquiry and research hitherto in use for the apprehension of the mysterious processes of life incapable of improvement? Are not these methods rather antiquated and worn out? Are they really able to put us in possession of the results we covet? Can we rationally expect that they will yet furnish us with solutions of the many problems still remaining with respect to the functions of the most important organs in the animal economy? Will they ever teach us the nature of inflammation or of fever?

No one who looks attentively at the progress of medicine during the last hundred years, can fail of being convinced, that while there has always existed a most earnest desire for a clearer insight into the vital processes, and a more accurate knowledge of the causes exercising a disturbing influence upon them; that while abundant energies have been directed toward the attainment of the highest aim of the science, there has hitherto been an hiatus which it is necessary should be filled up, a connecting link to the disjointed observations, and which must of necessity be supplied ere a more extensive and profound knowledge of the mysteries of organic nature can be attainable. The information we are in quest of is, what are the other forces of nature which co-operate with the vital principle in producing and sustaining the manifestations of life, the processes continually going on in all living organisms?

The inability to distinguish, and separate from each other, various effects in complex phenomena, render it impossible to refer each especial effect to its true cause. Hence the brilliant discoveries of comparative anatomy and physiology, which have enriched these sciences more in the course of a few decades of years than the labours of a thousand years previously, have exercised but a slight influence upon medicine.

All great pathologists, all the more intelligent physiologists, have from the beginning clearly and distincly recognised chemistry as the great desideratum—the needed link—and they have attempted the solution of the several problems presented them with such scanty and insufficient means as chemistry afforded in its infancy, and in the various stages of its development. Paracelsus, Van Helmont, and Sylvius—chiefs in their age—attempted to apply the experience of chemistry to medicine, they referred all the physiological, pathological, and therapeutical knowledge which they possessed to chemical principles. But they regarded the fluids of the animal body exclusively, they bestowed the suffrage, in physiological and pathological questions, to them, to the entire disregard of the solid parts of the organism, and all the changes

they witnessed and effects they studied were referred to the chemical operations of the animal fluids. But the definitions of acid, alkali, and fermentation, upon which they relied, and which they had borrowed from chemistry, failed, and these terms gradually acquired a very different signification.

The first principle of medical chemistry, namely, to take experience and experiment alone as the foundation and touchstone of theory, was altogether lost sight of in the explanation of vital phenomena, just because true experience—the real science of chemistry—could not keep pace with the progress of physiology and anatomy.

Thomas Willis, by giving an effectual impulse to the development of anatomy, prepared the overthrow of iatro-chemistry. Henceforth the solid parts of the body were more carefully and particularly studied, and the functions of the various organs, and every step in the progress of advancement made more and more evident the insufficiency of iatro-chemistry. The result was an estrangement and separation of medicine from chemistry. But never, not even during the prevalence of the theory of phlogiston, were chemical investigations and principles considered as non-essential to the apprehension of pathological and therapeutical phenomena. With a truly scientific spirit Boerhaave asserted the necessity of chemistry to medicine, pointed out their true relations, and exposed the folly of the iatro-chemists, and the vanity of alchemy.

Galileo, Kepler, Torricelli, and Lord Bacon, deposited in its grave the Aristotlean method of considering and explaining natural phenomena, so far as regarded its employment in natural philosophy, but they were unable to exercise any influence upon the theory of medicine, because chemistry itself, the foundation-stone of medicine, being threatened at that time in its own existence and independence as a science, found protection—a point of reliance and support, in the philosophical method of Aristotle.

The hypothesis of phlogiston, and the part it performed in natural phenomena, was, in fact, nothing more nor less than the union and incorporation of certain effects observed in nature, just in the same manner as the designation of other elements, *air*, *water*, *earth*, were incorporations of the conceptions of gaseous fluid and solid states of matter, and, at a later period, sulphur and mercury were general expressions of inflammability and metallic qualities.

The existence of phlogiston once assumed, the evolution of light and heat in combustion, and the alterations which substances undergo in chemical processes, were explained in the most satisfactory manner.

It was the phlogiston latent in bodies which was supposed to acquire motion, and to escape by the action of heat, and it was deemed perfectly rational to conclude that the properties of bodies must depend upon a certain proportion of phlogiston, salt, and earth, and that the metals should owe to phlogiston their hardness, their ductility, and their lustre. All was consistently enough explained. The existence of phlogiston seemed beyond a doubt, no one thought of attempting to prove it by any special argument. For were there no phlogiston there would have been no explanation of the phenomena. No phenomenon would have been explicable without phlogiston, all would have been darkness and doubt.

The advantage which the hypothesis of phlogiston presented at that time was that it kept together the ascertained facts and led to discoveries, as it served as a guide and stimulus to the search for new facts. The benefits of such an hypothesis are obvious enough; and yet, after all, it was nothing more than a mere description of phenomena—a *word which embraced the effects of many causes, and which word was taken and considered as the ultimate cause itself.*

At length the period arrived when this word lost its use and signification, when the better and more correct knowledge, the offspring of phlogiston, devoured its parent. The more minute and comprehensive study of heat, in specific and radiated caloric, the *more exact determination of the individual letters composing the word phlogiston*, led to the present state of chemistry, and the method arising from the study has led to the more profound and correct apprehension of chemical processes, and the causes by which chemical phenomena are produced, the introduction of which into physiology, pathology, and therapeutics, is the great desideratum of the present time.

The method of the phlogistic philosophers reached its climax in natural philosophy, and with this blossom the plant died, the leaves thereof faded, and the stem mouldered! The true fruit of it was the irresistible conviction which was forced upon every thinking and reasoning mind that no enduring results could be obtained by its means. New and better methods of investigation took its place, and herewith the essential condition was reached of a real and sound progress. Who does not recognise in the "vital principle" of the physiologists the old phlogiston theory dressed up and disguised in medical rags? As soon as you deprive them of this convenient phantasm all their explanations vanish into thin air! The simple search for phlogiston created a new science in chemistry; the search after the "vital principle" is preparing a new era in the medical sciences.

All that belongs to the phenomena of motion, to the form of the organs, their formation and development, the processes of absorption and secretion, have been ascertained by physiologists and anatomists, with a sagacity and with an expenditure of labour which must excite the greatest admiration. But the greater is the contrast when we compare therewith their explanation of the most simple chemical processes.

Chemistry inquires for the causes of fermentation, putrefaction, and decay, processes of gradual resolution of the higher order of atoms into the more and more simple, and finally into the original forms of these atoms, by the combination of which the most complex atom was formed. Chemistry here meets, in its way, with physiology, which attempts to solve the same problem by its own peculiar method. The physiologist discovers in fermenting fluids formations similar to the lower species of plants; he finds in putrefying matters a world of animalculæ; without entering upon any further inquiries, he assumes the mere concomitants of these processes to be their real causes. But is not this precisely analogous to the old phlogiston hypothesis? According to the physiologist, fermentation and putrefaction are effected by the development of fungi and infusorial animalculæ. But does this assumption render the process itself a whit the more intelligible? If the spores of fungi had generally the property of inducing fermentation in fluids, such a view would have some foundation, but such a property has not hitherto been observed by any one, nor has any attempt been made to prove its existence. When chemistry proves that in many processes of fermentation and decay, the resolution of complex atoms into simpler ensues without the presence of vegetable or animal beings, it is certainly most reasonable to suppose that the presence of these creatures, in the few instances where they are found, is purely accidental. If they were really the cause of the processes they ought to be found in all cases. I have elsewhere (Introductory Address, No. 10, LANCET, p. 395,) compared these notions with that of a child who attributes the flow of the Rhine to the water-mills at Mayence.

If the fungus be the cause of the destruction of the oak tree, and the microscopic animal the cause of the putrefaction of the dead elephant, what then causes the putrefaction and decay of the fungi and the animalculæ? They ferment and decay exactly in the same manner as the tree and the elephant; nothing remains of them but their non-volatile and earthy constituents.

Is it conceivable that plants and animals should be the causes of such effects as fermentation and putrefaction; that is, the destroyers and annihilators of organic bodies, parts of plants and animals, when they

themselves, and their own constituents, are subject to the very same processes of decomposition?

The influences of atmospheric air, of the aliments, of motion and rest, of heat and cold, and of remedial agents upon the animal body, both in health and disease, have long been recognised, and yet, nevertheless, phlogiston until very recently has, either openly or covertly been assumed, in all theories constructed to explain these influences, to enact the principal part.

The existence of hydropathic institutions, those dens of covetous and rapacious gamblers, where the wretched invalid resorts to throw the dice for health and life; the rise and progress of the homœopathic system, which treats truth with scorn, and bids defiance to common sense, loudly proclaim the need which exists for the adoption of settled principles, definite methods of research, and a systematic arrangement to guarantee their attainment and retention.

What are denominated by physiologists vital processes, embrace, besides the *vis vitæ*, the effects of many unascertained causes, the knowledge of which is essential if we are desirous to advance to a real comprehension of the ultimate cause of life, and which we must investigate in the phenomena which characterise the totality of life.

This knowledge can only be atained by means of the most persevering and unwearied efforts and researches; the *power*, the *means*, the *instruments* necessary to arrive at these results exist, and are in our possession.

The only method by which we can succeed, however, is by endeavouring to fix by numbers, measure, and weight, the apparently uncertain and ever variable phenomena. This is the method of Galileo and Bacon, the profound acuteness of its device, the precision of its results, the universal utility of its application, have been brilliantly manifested in the progress of chemistry.

Twenty-five years ago chemistry began to be applied to the more minute investigation of the constituents of the vegetable and animal kingdoms; the results which have been obtained are expressed in numbers, weight, and measure, after this method; we must now endeavour to introduce the application of numbers, weight, and measure, into physiology and medicine, to substitute them for mere unmeaning and empty sounds. The chemistry of the present day, in its proposed application to physiology and pathology, has none of the characteristics of iatro-chemistry.

It is not the true chemist who has endeavoured to apply to the animal organism, his notions derived from purely chemical processes, he has

not had the remotest intention of undertaking the explanation of any really vital phenomenon upon chemical principles. The only part which chemistry now and for the future can take in the explanation of the vital processes is limited to a more precise designation of the phenomena, and to the task of controlling the correctness of inferences, and ensuring the accuracy of all observations by number and weight.

The term *hydrogen*, for example, designates for every body a substance which is one of the constituents of water, but for the chemist the meaning of the term is far more comprehensive; it embraces an aggregation of properties; joined with other words, such as *chlorine*, *oxygen*, *sulphur*, *nitrogen*, &c., it presents to him a volume filled with thoughts and conceptions, and brings innumerable phenomena before his eye. The same may be said of a chemical *formula*, which is far more to the chemist than the expression of the results of an analysis; it renders intelligible to him the formation of the substance it designates, the products of its decomposition, together with the relations which it bears to other substances. Thus, by simply placing together the formulæ of alchol, of acetic acid, and of acetone, all the alterations and decompositions which attended the formation of acetic acid become at once perceptible. Without this method of designating chemical compounds no just apprehension of them is possible.

The physiologist, in his own way, has created for himself certain conceptions of *bile*, *saliva*, *cerebral substance*, *albumen*, *uric acid*, &c. including the physical properties of these substances, their colour, consistence, taste, &c., which he has ascertained, together with the relations he has observed them to bear to the organism and to its individual parts. But this physiological conception does not embrace all their properties and relations. In the hands of the chemist these organic matters manifest innumerable peculiarities in their relation to other substances, such as the raptitude to form combinations, to undergo decompositions; moreover, the knowledge of their elements, their invariable, composition, in short, all their chemical characters, belong to the word *bile*, *albumen*, &c., for the chemist. It must be perfectly obvious that the placing together of the words in the physiological sense can give us no information of their true import, their chemical meaning must form a part of their definition, if we are to comprehend all the points connected with them.

In the compound atoms of which the animal organism consists we observe the same fixed and immutable proportion as in inorganic nature. The laws of their chemical composition are as true for organic as for mineral substances. They ought not, and cannot, be disregarded by the true student of nature.

How strange it is that chemistry should have to fight a kind of battle in order to be permitted to render that assistance it can well afford to physiology, to extend and to augment, to make more precise and definite the significations of physiological terms and to correct the conception and definition of organic substances, their origin, properties, and relations!

It canot be disputed that a simple substitution of the *formula* of caseine for the word caseine, of the formula of cellular substance for the word cell, of the formulæ of bile, uric acid, &c., renders at once intelligible a number of relations which, without the formulæ, would be imperceptible, or, at least, in the greatest degree obscure. When the formula of caseine, compared with that of blood, tells us that caseine is identical in composition with the principal constituents of the blood, does not these bring us far nearer to the apprehension of its origin *from* the blood and its transformation *into* blood than we were before? A comparison of the formulæ of the constituents of the blood and of cellular substance points out to us how much oxygen must join, and how much carbon must separate from albumen or fibrine to convert these substances into cellular tissue; and if urea and uric acid are products of the transformation of living tissues, and ultimately of blood, does not the formula of urea and that of uric acid afford us a perfectly exact measure for the quantity of organic substance which has undergone this transformation? The formulæ speak for themselves, but what they tell us no longer belongs to chemistry, it now becomes a part of physiology.

I admit that the accurate determination of the composition and proportions of these bodies, and the assigning their numbers, appertains to the domain of chemistry, and may be called chemistry, but the application of the discoveries of organic chemistry to a more comprehensive and correct definition of the physiological conception, and to the more extensive apprehension of the properties, relations, and formations of these organic substances, belongs to chemistry only *de nomine.*

The production of iron from its ores is a metallurgic process, but the application of iron after it is produced to the manufacture of needles and innumerable purposes in the arts belongs not to metallurgy.

It is the same with respect to the methods of the chemist; it is only by mistake they are called exclusively *chemical* methods; they are methods in accordance with plain common sense and sound reason, and therefore are applicable everywhere and in all sciences.

The mineralogist is no longer misled by the infinitely various forms under which calcareous spar is found in nature; he is now, by the dis-

coveries of science, enabled to recognise it under any form, and to refer them all to a common basis.

It must be the same in disease, the morbific agent,—the medicinal substance,—may produce in two individuals effects very unlike in their manifestation, and yet the effects themselves must be the same; the symptom invariably indicative of this effect being observed in two, three, or four individuals, must be repeated in hundreds and thousands of instances. The symptoms in the aggregate, are, perhaps, never united in any individual, but if those present be correctly observed and rightly apprehended, it is impossible to mistake the causes of the disease, or to be in doubt as to the remedies required for its cure.

By simply making use of the acquisitions of chemists, of the profound knowledge now obtained respecting chemical forces, by applying the infinitely more precise knowledge we now possess of organic substances, and by introducing new methods, physiology and pathology will arrive at fixed and immutable principles. The acquisitions of anatomy can only in this way be rendered capable of useful applications, and no power on earth can stay the progress of science in this direction, which every one must acknowledge is the fruit of progress,—the offspring of the present age.

Ignorance will withdraw from science from the very moment in which it is compelled to verify conclusions by a well-regulated and consistent method of investigation, taking into account every condition of natural phenomena—every influence and contingency affecting the symptoms of disease. Even at the present moment physicians, by false interpretations of badly observed phenomena, lead each other astray and carry on interminable discussions and contentions about the most immaterial things. It was precisely the same with chemistry during its transition state, when the phlogistic theory was disproved. Everything was for the time unsettled, and every suggestion and hypothesis admitted; the old basis upon which the science rested was cast down, and the new one had not yet been established. All this is now altered; the true groundwork of the science is firmly established; the so-called practical chemist no longer looks down upon what is called theory with a smile of compassion or contempt, as is still frequently the case in medicine. No chemist relies any longer upon his own individual experience, in which he may be rivalled or surpassed by a clever peasant or shepherd. Formerly the chemist went to the soap-boiler, to the tanner, to the manufacturer, and artisan, whereas, at present, the soap-boiler, the tanner, the manufacturer, and artisan frequent our universities, because they know that it is science alone which can furnish them

with the master-key—the magic spell—the "*open sesame*" to unlock all the mysteries of their pursuits.

Just as at the present day the influence which the application of chemistry will exercise upon the solution of physiological and pathological problems is, by many physicians, considered worthy only of ridicule, so formerly were the advantages derivable from chemistry to arts, manufactures, trades, and agriculture, when first indicated, only laughed at by those who were pleased to call themselves practical men.

It has proved most injurious to science that so many individuals have made experiments without first obtaining any well-defined notion of the design or meaning of experiment. Such people have had the power and the will, but rarely have they proposed any definite object, any well-directed aim; they have employed a lever, but they have not ascertained the point upon which it turned. The reason that so many experiments have been made in vain, is simply and solely to be ascribed to the fact that comparatively few experimentalists have known how to observe natural phenomena, or understood the import of experimental research. It has been wholly overlooked by them that we do not by experiments examine nature; we do not study the phenomena themselves through which nature is manifested to our senses, and experiments are only of value inasmuch as they teach us to discover the errors of our inferences and to rectify our false conclusions from observation. If we could climb up to the rainbow, and could maintain the floating rain-drops in their position until we had concluded our observations and arrived at a correct apprehension of the phenomena, we should not need experiments. But being unable to do this, the philosopher was compelled to have recourse to experiments, to turn and turn a plain smooth, and then a triangular piece of glass for centuries, to measure and to calculate, ere he succeeded at last in apprehending the cause of the colours in the rainbow, their order and relations.

How admirable is that method, which with such scanty means could lead to the attainment of conclusions so correct as to the nature of phenomena which seemed to lie far beyond our reach! How much more accessible are those phenomena which plants and animals present to us in their vital processes! How much easier is the investigation into the conditions essential to life; the research for causes of disease, states which present themselves daily and hourly to our senses.

The animal body is as transparent as if made of glass to the intellectual eye of the physiologist. He knows definitely and positively the alterations which the air undergoes in the lungs, and yet, nevertheless, he requires an infinite number of experiments, without the least

value in themselves, to enable him to form a satisfactory theory. He agitates blood with air, and as he afterwards detects a trace of carbonic acid in the air, although without perceiving the slightest absorption of oxygen, he is satisfied that this evolution of carbonic acid suffices to explain the respiratory process, and yet a handful of wet sawdust or a leaf would have produced exactly the same result. How would it be, supposing that blood would not in this way yield carbonic acid when removed from the organism?

Innumerable experiments have been made to prove the nutritive properties of carbonic acid for plants, which all gave a negative result. Although it was most positively known that carbonic acid is absorbed by the green plant, that under the influence of light it becomes decomposed in the organism; that its carbon is assimilated and oxygen eliminated in a gaseous form. The experiments I allude to have no value whatever, because the experimentalists disregarded altogether the *conditions* necessary for the absorption and assimilation of carbonic acid by the plants, excluding everything, and neglecting every precaution, indispensable to the success of their experiments.

We hear every day of experiments of a similar kind. Thus, to ascertain whether sugar is capable of being transformed into fat in the living animal body, a dozen pigeons are stuffed daily with a quantity of sugar, which acts upon them like a medicinal substance, or a poison, and when after the lapse of from six to ten days they die of starvation, the experimentalist strangely expects to see them filled with fat, and is amazed to find himself disappointed. Thus, without knowing the conditions of the formation of fat in the animal organism, without stopping to inquire whether any conditions are required, the experiment is commenced by excluding every thing which would render its success possible. A state of artificial disease is produced in the animals; all nourishment is most carefully withdrawn from them, and thus they are deprived of everything necessary for the formation of blood—for the support of the vital processes, and, consequently, of that action which causes the formation of fat. By means of these cruel and wretched experiments these gentlemen believe they are able to prove that sugar, a non-nitrogenous substance, is incapable of being converted into fat, another non-nitrogenous substance. Such experiments prove nothing whatever, except the ignorance and total incapacity of the experimentalist to pursue these investigations.

Everywhere, and in all cases where we can succeed in ascertaining, from nature herself, the conditions of a phenomenon, our inferences possess a far higher value than they could ever acquire were they

derived simply from experiments. No experiments can ever contradict truths derived from the observation of nature. The great difficulty under which we labour in our experiments is the immense sacrifice of time and exertion required to imitate the conditions under which the observed phenomena manifest themselves in nature.

With a knowledge of those conditions our labour is concluded. The safest and most direct way is invariably to study nature for a knowledge of those conditions, and when we have ascertained them, further experiments serve only to guard us against mistakes, and to suggest useful applications of our knowledge.

Let us not render our labours futile by creating imaginary difficulties; those which exist already are quite enough for us to encounter.

Does the pathologist imagine that the chemist is desirous of seizing upon his territory? Has he acquired a possession in it from whence he may be ejected? Is he anxious to leave the Augean stable uncleansed?

It has been discovered that benzoic acid becomes hippuric acid in the animal organism, that the elements of benzoic acid perform a part in the secretory process of the kidneys, that they take a definite and traceable share in a vital operation, and may be employed for a definite purpose. Benzoic acid is a non-nitrogenous compound which can only be produced in the living organism of plants.

Now, if we find further that animals which, to their aliments, partake of no benzoic acid, but of other non-nitrogenous substances, likewise secrete hippuric acid in their urine to a considerable amount, whilst the urine of carnivorous animals contains no hippuric acid, am I in error in concluding that other non-nitrogenous substances, differing from benzoic acid, may also be used for the production of hippuric acid, and that they likewise participate in the secretory processes?

Now, in hippuric acid I still find the elements of benzoic acid; and I can by simply adding to benzoic acid another substance produced by the organism, form hippuric acid, whilst, *with other non-nitrogenous substances, this is possible only after they have undergone a series of transformations.* Does not this fact render it extremely probable, not to say certain, that vegetable medicinal substances,—themselves the products of the vital force,—may, in a manner exactly analogous, remove abnormal states of the animal body, if, by their composition, they are adapted for undertaking in the vital processes that part which the aliments can no longer perform because some part of the mechanism refuses its co-operation which is requisite to render these aliments fit for this purpose!

A lofty pillar may be saved from falling by a very small fragment of stone; the tooth of a wheel which has become loose in the works of a

clock may be soldered, and thus the clock restored to its original correctness. Now, I ask, does not the fragment of stone so employed become part of the pillar? Does not the solder enter into the composition of the wheel? A watch may stop for want of oil; a platinum wire divided, may be connected with a piece of silver wire, and the electric current which had been interrupted restored. Does not the silver become part of the platina apparatus, so far as the desired effect is concerned? Does not the oil employed to lubricate the axes of the wheels form part of the watch?

When the chemist deduces inferences from his observations, surely he does not go beyond his own sphere. It is true we may not be able at present to solve the problem how morphine and quinine operate in the organism; but we are surely proceeding in the right direction for obtaining a knowledge of even those points. My opponents object that my inferences respecting the effects of vegetable remedies are only probabilities, but they altogether overlook the circumstance that I myself never attempted to pass them off for anything else. If you deprive the investigator of nature of the power to make suggestions, to take probabilities to guide his future aims, you deprive him of all support, of all reasons to proceed in his investigations. The chemist, as well as every other philosopher, must conceive some probable object toward which to direct his researches.

Would it not be exceedingly absurd to expect that plants would grow without seeds, to desire to engraft a noble tree upon an ignoble stock, whilst you reject the scion! How can we sow with the hope of a harvest without having a fertile soil at our disposal? Our desire is to winnow well the grain until all the chaff is cleared away.

If I were called upon to decide what right physiologists and pathologists have to form an opinion with respect to the inferences deduced from chemistry to aid physiology, and my judgment were guided by the facts and inferences cherished and fought for by these gentlemen, the amount of credit I could award to them would be represented by a very small figure.

When resting upon the fact of the transformation of benzoic acid into hippuric acid, a fact established in the most exact and decisive manner, I deduce a certain inference and catch a glimpse of a little more of the horizon of truth than my opponents, is it natural for them to desire to put out my eyes?

When, from the weight of the bile, which, according to the assertions of the physiologist, an ox secretes every day, and the weight of the blood-constituents which the same animal partakes of in its food in the

course of twenty-four hours, I infer that the non-nitrogenous constituents of his food (gum, starch, sugar, &c.) must likewise participate in the formation of the bile, because the amount of carbon contained in the bile is greater than is contained in all the blood-constituents partaken of together, can this conclusion be called in question?

When, from not finding any bile in the fæces, I maintain that the bile must, in some manner, return into the circulation, to serve ultimately for the respiratory process, which means no more than that its carbon and hydrogen are eliminated from the organism in the form of carbonic acid and water; and further, when the physician finds that in cases where, by the administration of calomel, the bile, altered but little in its properties, is evacuated in the stools (known as calomel stools), the absence of the matter needed for respiration causes all the inspired oxygen to be directed towards the cause of the disease, and owing to this circumstance the disease is removed, can my inferences be doubted? Nevertheless, I do no more than desire my opponents to consider them as probable, and to submit them to the test of examination. But this has no weight with such people.

If some young author relates a tissue of marvellous tales to support an opinion that there exists certain states of disease in which the blood, which contains 80 per cent. of water, the flesh and tissues 75 per cent., and the bones 30 per cent. (thus altogether three-fourths water), may burn from within, in the absence of oxygen, these same physiologists will believe his assertions.* Our author has not, indeed, himself witnessed any case of this kind, he has never been in a situation to establish even a single one of the facts upon which the whole fabric of his tale rests; but it would require too much self-denial, a superhuman effort, to destroy such splendid tales, which render his book or his lectures so interesting!

* "What thing did you see? Speak boldly."

"I have seen a ship," said I, "going against a fierce wind with the same velocity as a horse, and that by the vapour of boiling water."

"Hajji," said the king (after a stare and a thought), "say no lies here. After all, we are a King. Although you are a traveller, and have been to the Franks, yet a lie is a lie, come from whence it may." * * * * "So you encountered great tempests!" said the Shah. "Say on Hajji, everything you have in your heart, say on."

"Yes, may it please your Majesty," said I, "one tempest we encountered, on our passage from England to Constantinople, was so great, that, venturing to look overboard to see how fast we were going for the good of your Majesty's service, and happening to leave my mouth open, a fierce wind entered, and blew three of your slave's teeth down his throat." Upon this I opened my mouth and showed the damage which my jaw had sustained from the kick of a Curdish horse.

"Are there such winds, indeed?" asked the Shah. "In truth they rush down with violence enough from the neighbouring heights of Albo."—*Hajji Baba in England.*

With the same easy credulity, people of this sort firmly believe that an individual suffering from diabetes emits more water as urine than he partakes of through the mouth. They, indeed, weigh the water which the patient drinks, but they take no account of the water in the milk partaken of (94 per cent.), in the bread (24 per cent.), in the meat (76 per cent.) Being either without the ability or the will to establish or refute the statement advanced, they assume it at once to be an indisputable truth.

If the public would take the trouble to test these marvellous stories (a task no one seems willing to undertake), it would soon be discovered that the evidence for them is precisely on a par with, and equally entitled to credit, as the certificates of the efficacy of *incomparable oils* for the cure of baldness, of *bear's grease*,† of vegetable pills, &c. On inquiry, it would be found that the bald heads, the ladies of quality who vouch for the marvellous cures, have just departed this life, or set out upon a journey,—they are never seen.

It is such people as these who believe the impregnation of the ovum without contact with the seminal principle not only possible but positively certain, and who bring forward, in proof of this assertion, instances which there cannot possibly be any opportunity of testing.

In criminal law, upon a charge of manslaughter or murder, the judge pronounces judgment only after the fact is well-established,—first, the *corpus delicti*, than the accusation, then the sentence, but these gentlemen care nothing about the establishment of the fact. If any rare morbid state, any reputed effect of a remedy, any pathological phenomenon, with which they are unacquainted, falls into the hands of this class of persons, all their egotism is aroused, truth is altogether disregarded. An imaginary criminal, as the cause, is created, whom they subject to the torture and the rack. Old women, fools, and children of all countries, are dragged forth to supply evidence, and the groans and sighs of the suspected innocent are interpreted as confessions in proof of their predetermined decision. Analogy is, with these people, converted into the bed of Procrustes, they stretch or cut off the limbs of facts and arguments, unscrupulously, and at their own sovereign pleasure.

In instances where a medical author advances such strange and imaginary opinions, the public seems to show an indulgence and kind forbearance which certainly is never exhibited towards writers upon other sciences. Too many established practitioners care less for the

† Original—*lion's grease*, which our German friends employ instead of bear's grease, but with equal effect!!

advancement of science in their publications than for the extension of their own reputation for sagacity and penetration; whilst many a candidate for practice, pressed by his pecuniary necessities, writes a book as the best means of advertising himself; and to impose thus upon the public requires so very little labour or skill, that we may almost wonder that such works are not still more numerous.

In chemico-physiological works, physiology is threatened with danger, not from chemists, but from physiologists themselves and physicians.

It is not chemistry which asserts that peroxide of iron and protoxide of iron perform a part in the respiratory process; this assertion is made by physicians.

Chemistry knows but one organic compound, which invariably contains iron as a constituent. It is not a chemist who considers proteine the basis of blood and the tissues, but it is the iatro-chemist, who has introduced into the vital process the idea of the organic radicals. The chemist has not done so, because he knows that acetic acid may be derived from wood, and in its anhydrous state has the same composition as wood, and because he knows that acetic acid may be derived in the same manner from a thousand other substances, without being (on that account) the prototype of their constitution.

The iatro-chemist knows a proteine tritoxide, and deutoxide, he determines the atomic weights of fibrine, albumen, and caseine from their combinations with hydrochloric acid and peroxide of lead. It is he who wishes to establish the absolute number of atoms composing the elements of proteine, who disputes about the formula; this is the iatro-chemistry of the present time.

It is iatro-chemistry which proposes to make the addition of an atom of oxygen to *lung* tubercle render intelligible the formations of *liver* tubercle, which is just as clear as to suppose the addition of oxygen to ear-wax in an ear-spoon (cochlea), to make *spiritus cochlearia*.

I am perfectly aware that I bear the blame of many of these deductions, which I do not hesitate utterly to repudiate.

Iatro-chemistry, not chemistry, pretends to prove from the compositions of mould which forms in a solution of the sugar, that plants derive their nitrogen from the gaseous nitrogen of the atmosphere; for chemistry knows that pure solution of sugar does not admit the formation of any mould whatever. Chemistry knows that the so fabulously powerful vital principle is incapable of employing any element as the constituent of an organism. Chemistry knows that it is not *diamond* which nourishes the organism, but a carbon compound; not *hydrogen*,

but a hydrogen compound; not *sulphur*, but a sulphur compound, and from this infers that nitrogen, also, cannot be assimilated as an element, but only in the form of a compound, which inference is moreover supported by the most direct and positive proofs.

In concluding these remarks, I cannot conceal from myself the little probability there is of their accomplishing any good, because those who have understood my works needed not a single line of explanation of this kind, and as for my opponents, they would choose to consider the most lucid explanation of mine as mere shadows and darkness. We need not alarm ourselves that the trees will grow into the skies, since nature and Providence alike forbid it; our own watchfulness, or an army of preventive police would be superarogatory.

I have pronounced my own opinions against the views of some individuals, who by the greatest and most transcendent merits have acquired my esteem, which will never diminish, but *they* must not forget that they have also their opinions, which do not offend me, because nothing can offend or disturb me on my way, since I shall ever maintain the courage to proceed right onward as long as my powers continue.

Note.—In the second volume of Berzelius's Manual, 5th edition, after describing my method of separating antimony from arsenic (by fusion of regulus of antimony with sulphuret of antimony and carbonate of soda), he says, "the antimony thus obtained is not so free from arsenic as that obtained by Wöhler's method."

If I understand this phrase aright, it means that antimony is not by my method obtained free from arsenic. Now, although I am always anxious to avoid discussions when my theoretical notions are assailed, I cannot remain silent, for science and the truth's sake, when facts are thus called in question. This method has been employed many hundred times in my laboratory, and has never failed. It has been repeated in other places also, and has invariably yielded antimony free from arsenic. Besides a few observations of Buchner's (Rep. new series 8, p. 266), no objections against my method have reached me in chemical literature, and the remarks of Buchner did not apply to the remaining presence of arsenic, but to loss of weight, &c., a subject discussed in the Annalen, bd. 22, p. 58. I cannot conceive what reason Berzelius has to condemn this method.

In his 23rd Annual Report, p. 177, Berzelius remarks upon my method of separating cobalt from nickel by means of cyanide of potassium. "He (Liebig) further states that he has applied cyanide of potassium as a means of separating metals from each other, and, for an instance, he gives a method for the separation of cobalt from nickel

&c. An experienced eye perceives, immediately, that this method has not really been tested by analysis, which, moreover, would render necessary various methods, according to the varying relative proportions of the metals, and that it is fraught with more difficulties and sources of error than the common method of separating with ammonia and potass."

Altogether disregarding the circumstance that Berzelius gives an incorrect report of my method, this is not the first occasion on which he has deserted his formerly so stoutly defended principle of allowing facts to speak and not opinions. I think it would have been better to have made an experiment than to have expressed an opinion based, as it is, upon an erroneous notion. Berzelius would then, probably, have satisfied himself, and this with the aid of my method, that the separation of cobalt from nickel by means of ammonia and potass is very incomplete and imperfect, since either the oxide of cobalt remains in solution, or the precipitated oxide of nickel contains oxide of cobalt.

I am, as is well-known, a teacher of chemistry in a university, and annually instruct above one hundred students in the art of analysing minerals, and, amongst others, in the separation of nickel from cobalt. My method, which Berzelius thinks exists only on paper, is, therefore, very often tried, and hitherto it has been found, invariably, that no better method can replace it; perhaps, because it depends upon a more correct principle of separation than other methods. I can only express my regret that Berzelius should have paid so little attention to the experiments of Fresenius and of Haidlen relating to the application of cyanide of potassium in chemical analysis, for these experiments constitute the most valuable contribution which mineral analysis has of late, received.

Manufacture of Epsom Salts.

The note, page 310 in our last number, relative to the process suggested in the paper of Lieut. Latter on the method of treating sulphurets of copper at Lyons, having attracted the notice of Messrs. Bathgate and Co., it was intimated to us, that sulphuric acid since the erection of their large chamber, has become so cheap as to be had for little or nothing. Conceiving the circumstance to be favourable for resuming the experiments in the manufacture of salts, referred to vol. 2, p. 244, we ascertained from Messrs. Bathgate

and Co., that we might have the acid, specific gravity 1700, in quantities of not less than 100 maunds, at 6 Rs. per maund, for purposes of experiment.

We accordingly tried a maund of the acid on the magnesian limestone of Salem, an account of which mineral will also be found, vol. 2, p. 284 of this Journal. The result yielded 144 lbs. of Epsom salts from 38 lbs. of the calcined rock.

Taking the magnesite at Rs. 20 per ton, and the acid of the above specific gravity at 6 Rs. per maund, the Epsom salts afforded, which are very pure, costs 13 shillings and 3 pence per cwt. The imported salt from England costs, including freight and charges, 24 shillings. Having reported this result to the Medical Board, it was not deemed expedient to go on with the experiment to the extent proposed, with the view to supply public service. We would therefore recommend the subject to sulphuric acid manufacturers, as an useful way of employing their superfluous acid. The consumption of Epsom salts is becoming every year more general in proportion to the spread of European medical knowledge, the native sources and means of supply of all such articles, thus become proportionably more and more important.

There is however, another point of view in which this question becomes important; so long as we are depending in India on supplies of medicine from Apothecaries' Hall, our stock is liable to become exhausted. When the consumption exceeds the anticipated expenditure, which it almost always does, we are then obliged to make up the deficiency from such articles as we can collect in the bazars, sometimes at exorbitant rates. The cheap production of the common articles of medicine, such as Epsom salts, from the natural productions of the country, would prevent this, and also be the best check on the venders of adulterated drugs. Besides, it is the cheap and bulky articles of medicine which it becomes us most especially to prepare in India, since they are less worth their freight and the room they take up on board ship, than

the more costly stores, such as quinine. The government are well aware of this, and in the paper above alluded to on this subject in a former number, it is stated in a note that the Governor General in Council was surprised to find no less than 18 tons of Epsom salts and other bulky articles of a similar nature included in our annual indents for medicines on Europe, calling at the same time on the Medical Board to institute enquiries as to the means of supplying such articles in India. Now that we have succeeded so well with regard to Epsom salts, we hope the Medical Board will be induced to re-consider the subject, and authorise the necessary supply to be furnished here, instead of occupying ships with such unnecessary importations to the neglect of the natural productions of this country. The production of Epsom salts from the Salem rock may be effected as above shewn at so cheap a rate, as altogether to secure the public against its adulteration in the bazars, with the numerous poisonous articles which, from its high price at present, are frequently mixed up with it. According to Lieut. Ouchterlony, of the Madras Engineers, the rock is abundant in Trichinopoly, Coimbatore and Mysore, its principal localities being in Salem.

Its sites are said by Lieut. Ouchterlony to be near enough to the banks of the Cavery, to allow of its being brought down that stream to Porto Novo on the coast, at a very low rate of not so much as 10 Rs. per ton, or probably a great deal less.

In the manufacture of sulphate of magnesia, from this rock, in the Laboratory of the H. Co's. Dispensary, which proved so satisfactory, it is first broken up into lumps of convenient size and thrown into the fires which are kept up for other purposes, and thus calcined. It is then pounded, mixed with water, and dissolved at once with acid, and filtered through cloth. The solution is then evaporated till a pellicle forms, and set aside to crystallize.

On a large scale the rock should be burnt in a kiln like limestone; but a quantity sufficient for the public expenditure

at present might be made without this, and two or three coolies would be sufficient to conduct the whole process.

Coal from the Falls of the Jamuna, in Assam.

Results of the chemical examination of two specimens of Coal from near the Falls of the Jamuna, Nowgong district, Lower Assam.

Received from Major Jenkins, April 1844.

Sp. Gr. 1.2.

Bituminous volatile matter, ...	46.0
Carbon, ...	53.4
Light yellow White Ash, ...	0.6
	in 100 parts.

Colour-black and shining, with a resinous lustre, and temper-steel tarnish.

Quality, of the most superior description, better even than Cherra Ponji, or any other coal hitherto found in India.

J. M'Clelland,
Secretary Coal Committee.

Laboratory H. Co's Dispensary,
27th April, 1844.